12-1965

Costs of processing snap beans for freezing in Tennessee

George W. Bullion

To the Graduate Council:

I am submitting herewith a thesis written by George W. Bullion entitled "Costs of processing snap beans for freezing in Tennessee." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

William E. Goble, Major Professor

We have read this thesis and recommend its acceptance:

Charles Cleland, Howard Dye, Curtis Lard

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

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

December 1, 1965

To the Graduate Council:

I am submitting herewith a thesis written by George W. M. Bullion entitled "Costs of Processing Snap Beans for Freezing in Tennessee." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

Major Professor

We have read this thesis and recommend its acceptance:

Accepted for the Council:

Dean of the Graduate School

COSTS OF PROCESSING SNAP BEANS FOR FREEZING IN TENNESSEE

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

George W. M. Bullion

December 1965

ACKNOWLEDGMENT

The writer is indebted to many people for the opportunity he had to pursue his M. S. degree. It was only through the financial assistance provided by the Agricultural Experiment Station of The University of Tennessee that this opportunity was possible. It was through the encouragement and guidance of Dr. Thomas J. Whatley that the writer entered the Master's program and was able to successfully complete it.

Appreciation is expressed to the managers of the four firms processing snap beans for freezing. They readily opened their books, records, and plants for the study even though they were under no obligation to cooperate.

Special gratitude is extended to Dr. William E. Goble, the chairman of the writer's graduate committee. Any attempt to express the writer's gratitude to Dr. Goble will fall short of its full intent. Special acknowledgment is given to Dr. Charles Cleland, Dr. Howard Dye, and Dr. Curtis Lard who made many helpful suggestions for improving this thesis.

Appreciation is extended to the clerical staff of the Department of Agricultural Economics for their help in the preparation and typing of the manuscript. Special appreciation is extended to Miss Mary Rogers, Mrs. John Elson and Mrs. Earl Jordan. Appreciation is also extended to Mrs. Georgia Troglen for typing the final manuscript.

Full appreciation is extended to the writer's wife who was with him throughout his Master's program. She unselfishly gave of her time and understanding during those occasions when her husband became discouraged in this study.

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CHAPTER I

INTRODUCTION

Vegetable processing is an important segment of the agricultural processing industry. During the 1963 season, 1,595,370 acres of the principal vegetable crops were harvested for processing in the United States. The total volume of input for the vegetable processing plants was 7,968,490 tons with a value of $320,533,000. In the South Central Region of the United States (Arkansas, Alabama, Kentucky, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas), there were 74,130 acres of the principal vegetable crops grown for processing with a yield of 240,030 tons. The value of this production in the South Central Region was $11,682,000 (Table I).

The five major regions producing vegetables for processing in the United States rank in the following order: 1. North Central, 2. Western, 3. North Atlantic, 4. South Atlantic, and 5. South Central. Within the South Central Region, Tennessee ranks second to Texas in planted acreage, harvested acreage, production, and value of the major vegetable crops grown for processing. During 1963 in Tennessee, 16,310 acres of the eight major vegetable crops were harvested for processing. The 16,310 acres does not include 13,000 and 3,000 acres, respectively, of field peas and lima beans harvested for processing during 1963. The total acreage was 33,310 harvested for processing. The 16,310 acres yielded a total of 37,000 tons with a gross value of $3,107,000 (Table I).

TABLE I

RANK, NUMBER OF VEGETABLE CROPS GROWN, ACRES PLANTED, ACRES HARVESTED, PRODUCTION AND VALUE OF PRINCIPAL VEGETABLES GROWN FOR PROCESSING IN THE SOUTH CENTRAL STATES AND FIVE REGIONS OF THE UNITED STATES DURING 1962 AND 1963

State	Rank	Number of crops	Planted		Harvested		Production		Value	
			1962	1963	1962	1963	1962	1963	1962	1963
			(Acres)		(Acres)		(1000 tons)		($1000)	
Texas	1	7	24,750	27,150	22,450	26,350	92	127	3,387	4,483
Tennessee	2	8	15,660	16,760	14,700	16,310	32	37	2,693	3,107
Arkansas	3	8	15,070	14,170	13,830	12,970	32	29	1,951	1,696
Oklahoma	4	5	10,350	8,300	8,500	6,750	19	16	1,074	872
Alabama	5	4	5,100	4,700	4,650	4,600	10	11	464	479
Mississippi	6	1	4,950	5,700	4,900	4,100	11	10	590	530
Kentucky	7	3	2,450	2,350	2,450	2,300	10	9	473	443
Louisiana	8	4	580	1,020	580	750	[a]	1	28	72
North Central	1		732,350	688,640	699,370	665,980	2,927	2,632	96,388	89,105
Western	2		593,330	507,420	565,950	496,770	4,455	3,674	178,412	153,207
North Atlantic	3		208,910	193,080	204,280	183,420	1,193	916	50,361	40,601
South Atlantic	4		180,460	183,510	174,820	175,070	567	507	26,609	25,938
South Central	5		78,910	80,150	72,060	74,130	206	240	10,660	11,682
United States			1,793,960	1,652,800	1,716,480	1,595,370	9,348	7,969	362,430	320,533

[a]Less than 500 tons.

Source: United States Department of Agriculture, Vegetable-Processing, 1963 Annual Summary (Washington: Government Printing Office, December 1963), pp. 6-7.

Of the 1,595,370 acres of the principal vegetable crops harvested for processing during 1963 in the United States, 12.1 per cent or 192,720 acres were snap beans. Table II shows that 305,060 acres of snap beans were grown but 36.8 per cent of the total acreage was for the fresh market. It has been a practice in past years for the processors to obtain and process, in some instances, lower quality commodities which remained after the market demand was satisfied. In more recent years, however, growers have been producing snap beans and some additional vegetable crops primarily for processing. For example, 88.4 per cent of the snap bean production was produced for processing for the period 1961-1963. This increased production developed primarily because of reductions in acreage allotments on cotton and tobacco, mechanization, and the increased demand of vegetables for processing.

I. THE ECONOMIC PROBLEM

Plants freezing snap beans are typical of most firms processing agricultural products inasmuch as the plants are constructed to operate at a constant rate with a relatively fixed labor requirement. The processing firms usually operate on a seasonal basis to coincide with production in Tennessee. There are some plants, however, that process during seasons when snap beans are not available in Tennessee. Total output is adjusted by varying the hours of operation since it is not likely

TABLE II

SNAP BEANS FOR PROCESSING AND FRESH MARKET IN UNITED STATES: ACREAGE AND YIELD PER ACRE, PRODUCTION, PRICE PER TON AND VALUE, AVERAGE 1957-61, ANNUAL 1962 AND 1963

Item	Processing snap beans			Fresh market snap beans			Total crop		
	Average 1957-61	1962	1963	Average 1957-61	1962	1963	Average 1957-61	1962	1963
Planted acreage	173,980	189,560	203,010	133,240	121,920	120,490	306,320	311,480	323,500
Harvested acreage	166,270	182,410	192,720	122,630	114,820	112,340	288,900	297,230	305,060
Yield per acre by tons	2.40	2.50	2.40	1.40	1.90	2.40	2.15	2.23	2.24
Production by tons	395,340	450,120	470,870	225,800	213,350	212,150	621,140	663,470	683,020
Price per ton	$109.50	$101.80	$ 99.40	$191.12	$185.33	$187.21	$132.07	$128.67	$126.67
Value ($1000)	$43,154	$45,826	$46,799	$38,879	$39,541	$39,716	$82,033	$85,367	$86,515

Source: United States Department of Agriculture, Vegetable-Processing, 1963 Annual Summary (Washington: Government Printing Office, December 1963), pp. 4-5.

to be feasible to adjust total output by varying the rate of output per hour. The net effect is to produce a constant per-unit cost for such items as labor for finished product, packaging materials, repairs, and equipment service.[1] In Figure 1 (A and B) the variable cost is constant regardless of the level of output, and the resulting effect is that total variable cost increases at a constant rate.

If the firms had the alternative of adjusting total output by varying the output rate per hour instead of the hours of operation, they would encounter a situation similar to the one pictured in Figure 1 (C and D). The variable cost per unit of output would decrease up to some given output level, and then the variable cost per unit of output would increase. The total variable cost would increase at a decreasing rate, reach an inflexion point, and then increase at an increasing rate.

The other cost component with which the processing firms are concerned is the fixed factor cost. In the short run, which is a period of time in which plant size cannot be expanded or contracted, the firms encounter large quantities of fixed cost. As volume of total output is increased, regardless of how it is obtained, the fixed cost per unit of output decreases as illustrated in Figure 2(A). Regardless of how output is increased in the short run, the fixed cost per unit depends only upon the total output. Figure 2 (B) shows total fixed cost is constant

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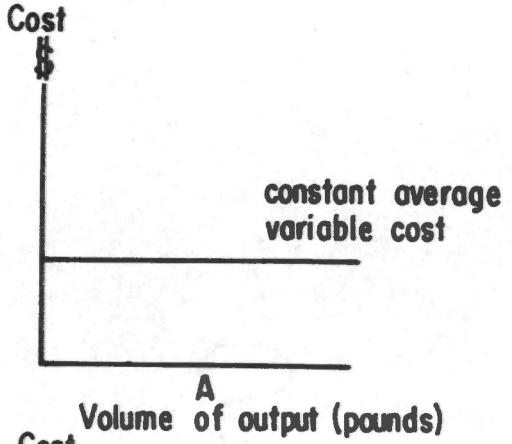
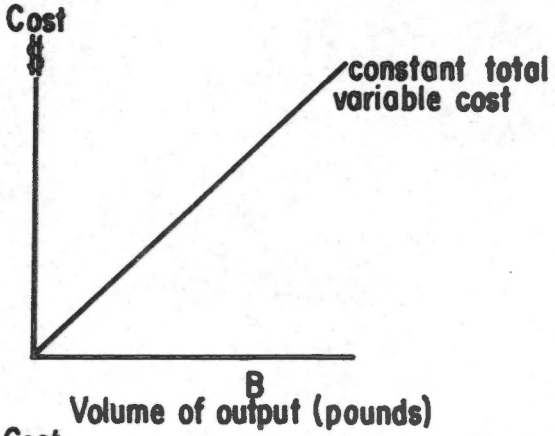
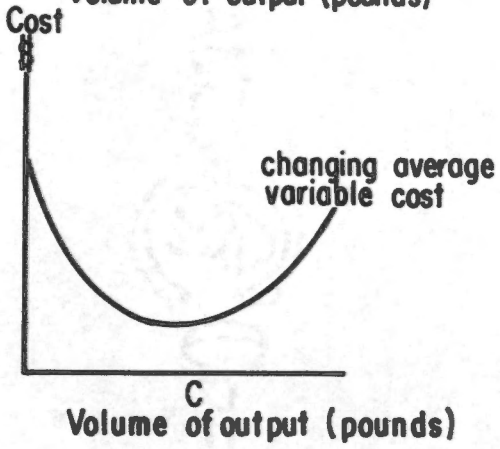
[1] Robert D. Dahle and John F. Stollsteimer, Planning Agricultural Processing for the South, Snap Bean Canning, Agricultural Policy Institute (Raleigh: North Carolina State University, August, 1964), p. 7.







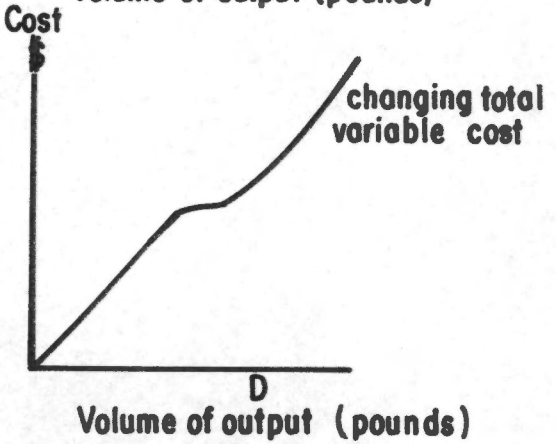


Figure 1. Relationship of volume to constant average variable cost and constant total variable cost, and to changing average variable and changing total variable cost. (From Sidney Weintraub, Intermediate Price Theory, Philadelphia: Chilton Company, 1964, pp. 46-47; and Richard H. Leftwich, The Price System and Resource Allocation, Revised, New York, Chicago, San Francisco, Toronto: Holt, Rinehart, and Winston, 1963, p. 166, respectively.)

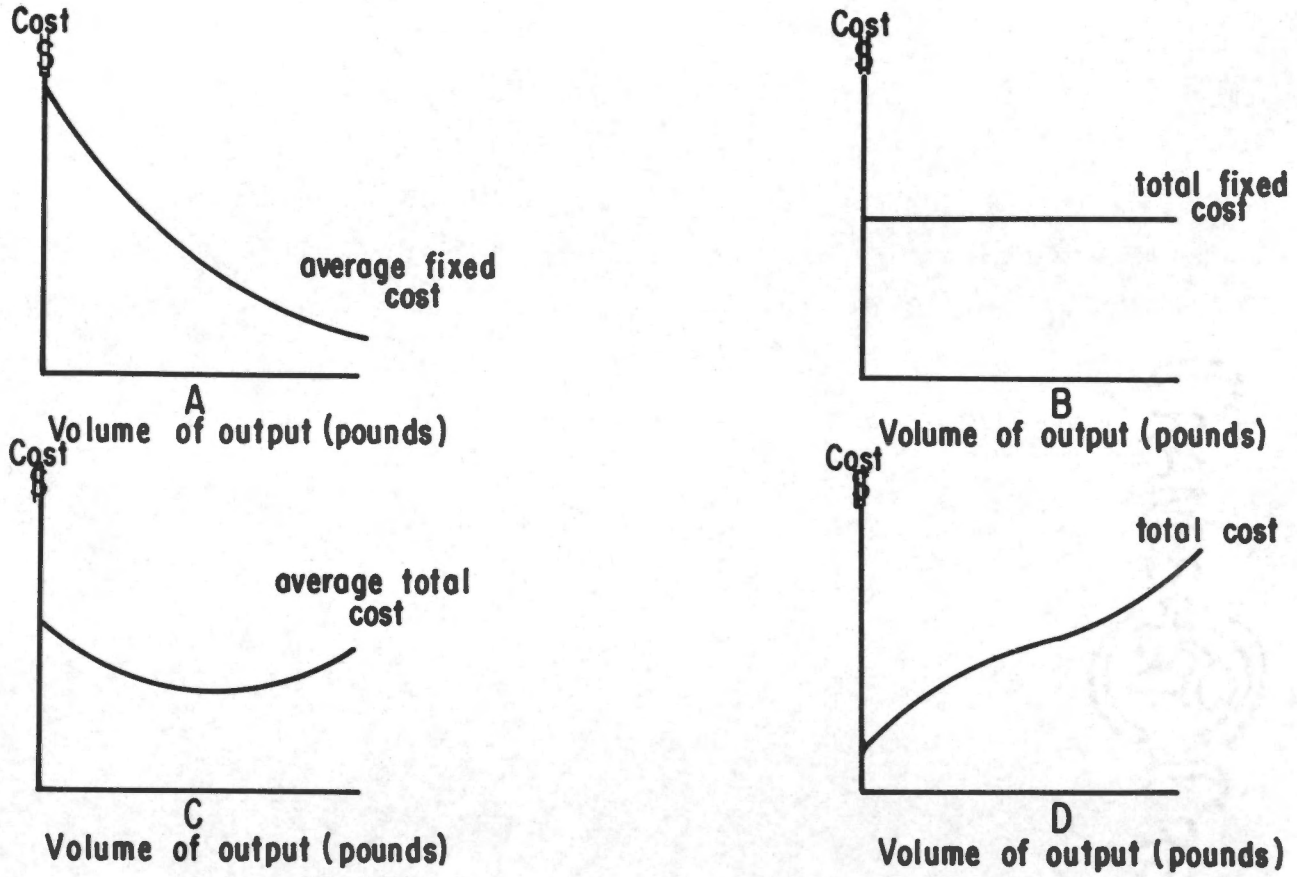


Figure 2. Relationship of volume to average fixed cost and total fixed cost, and to average total cost and total cost. (From Richard H. Leftwich, The Price System and Resource Allocation, Revised, New York, Chicago, San Francisco, Toronto: Holt, Rinehart, and Winston, 1963, p. 167; and Sidney Weintraub, Intermediate Price Theory, Philadelphia: Chilton Company, 1964, pp. 46-47, respectively.)

regardless of the level of output. Figure 2 (C) shows that average total processing cost per unit decreases as the volume of total output is increased up to some point. After a certain total output level is reached, the net diseconomies will outweigh any economies of scale, and the average total processing cost will increase.[2] Figure 2 (D) shows that when total output is adjusted by varying the rate of output, the total cost increases at a decreasing rate and then at an increasing rate.

Figure 3 shows fixed cost at OA for all output levels regardless of how total output is expanded, either by increasing rate of output (x) or time of operation (t). When the total output is adjusted by varying the time of operation, the total cost changes at a constant rate.[3]

When total output is increased by making successive additions to the plant without changing the proportion of variable factors employed, the total cost function will increase in a constant or linear form although it will be discontinuous. The total cost function will increase in steps as illustrated in Figure 4. This type of cost behavior has some important implications on the most profitable size of plant.[4]

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[2] Ibid., p. 8.

[3] B. C. French, L. L. Sammet, and R. G. Bressler, Hilgardia, Vol. 24, No. 19, California Agricultural Experiment Station (Berkeley: University of California, 1956), p. 572.

[4] Ibid., p. 555.

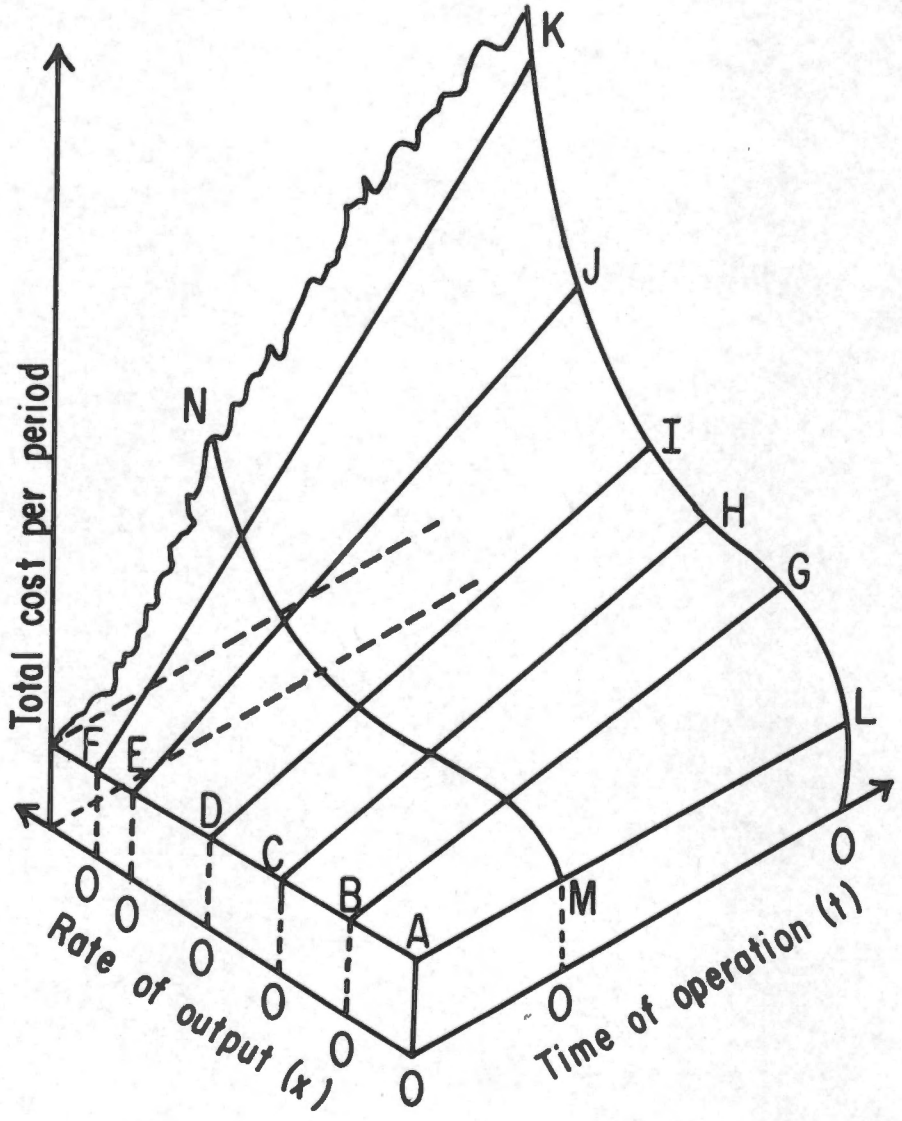

Figure 3. Rate-time cost surface for a given plant, including "fixed costs" for durable capital goods. (From B. C. French, L. L. Sammet and R. G. Bressler, Hilgardia, Vol. 24, No. 19, California Agricultural Experiment Station, Berkeley: University of California, 1956, p. 573.)

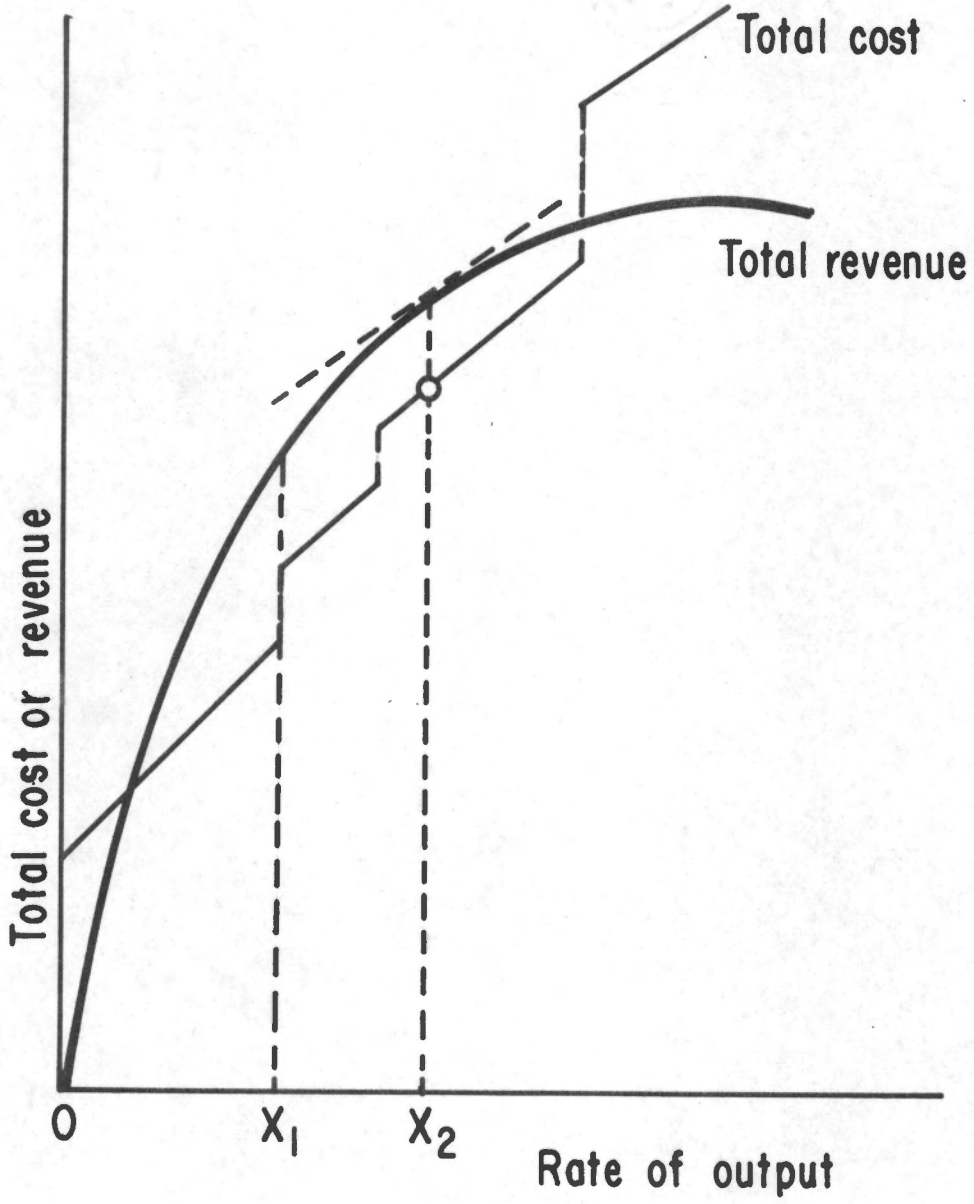

Figure 4. Total cost and profit response to varying rate of output through plant expansion. (From B. C. French, L. L. Sammet, and R. G. Bressler, Hilgardia, Vol. 24, No. 19, California Agricultural Experiment Station, Berkeley: University of California, 1956, p. 554).

TABLE III

ACRES OF SNAP BEANS HARVESTED FOR THE FRESH AND PROCESSING MARKET IN TENNESSEE AND THE UNITED STATES, 1963

Area	Harvested	Production[a]	Fresh and processing volume as a per cent of total volume	Freezing and canning volume as a per cent of total volume processed
	Acres	Pounds	Per cent	Per cent
Tennessee				
Fresh market	1,400	6,300,000	12.4	--
Processing	11,100	44,400,000	87.6	100.0
a. Freezing	(5,280)	(17,918,185)	(35.4)	(40.35)
b. Canning	(5,820)	(26,481,815)	(52.2)	(59.65)
Total	12,500	50,700,000	100.0	
United States				
Fresh market	112,340	424,300,000	31.1	--
Processing	192,720	941,740,000	68.9	100.0
a. Freezing	(48,090)	(250,160,000)	(18.3)	(26.6)
b. Canning	(144,630)	(691,580,000)	(50.6)	(73.4)
Total	305,060	1,366,040,000	100.0	

[a]Yield was 4,000 pounds per acre.

Source: United States Department of Agriculture, Vegetable-Processing and Vegetable-Fresh Market, 1963 Annual Summaries (Washington: Government Printing Office, December 1963), pp. 14-15, 20-21, respectively.

II. JUSTIFICATION OF THE PROBLEM

A total of 12,500 acres of snap beans was harvested during 1963 in Tennessee (Table III). Of the 50,700,000 pounds harvested in Tennessee, a total of 44,400,000 pounds or 87.6 per cent of the total was for processing. The 87.6 per cent of the acreage harvested for processing in Tennessee was higher than the 68.9 per cent of the acreage harvested for processing in the United States.

Tennessee has a place of some prominence among the 18 states processing snap beans. It increased in planted acreage and harvested acreage from 8th position in 1957-61 to 5th position in 1962 and 1963. In yield per acre and price per ton, Tennessee ranked 5th place in 1957-61, 6th in 1962, and 7th in 1963. This change was probably caused by increased emphasis on production for processing. When a crop is grown and harvested mechanically for processing, the yield per acre usually declines along with a decrease in price per ton. In production, the State went from 7th place in 1957-61 to 5th position in 1962 and 1963, and in value of snap beans, it increased from 6th position in 1957-61 to 5th in 1962 and 1963.[5] Table IV shows that the yield per acre for processing beans was 2.0 tons compared with 2.25 tons for the fresh market beans during 1963. Also, the price per hundredweight for processing and fresh market beans was $5.40 and $6.20, respectively.

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[5]United States Department of Agriculture, Vegetable-Processing, 1963 Annual Summary (Washington: Government Printing Office, December, 1963), pp. 14-15.

TABLE IV

SUMMARY OF SNAP BEANS GROWN IN TENNESSEE FOR PROCESSING AND FRESH MARKET: ACREAGE, YIELD PER ACRE, PRODUCTION, SEASON AVERAGE PRICE RECEIVED BY GROWERS, AND VALUE, AVERAGE 1957-61, ANNUAL 1962 AND 1963

Item	Processing snap beans			Fresh market snap beans			Total crop		
	Average 1957-61	1962	1963	Average 1957-61	1962	1963	Average 1957-61	1962	1963
Planted acreage	7,800	9,700	11,300	1,140	1,200	1,400	8,940	10,900	12,700
Harvested acreage	7,620	9,700	11,100	1,120	1,200	1,400	8,740	10,900	12,500
Yields per acre by tons	2.2	2.0	2.0	2.25	2.0	2.25	a	a	a
Production by tons	16,880	19,400	22,200	2,500	2,400	3,150	19,380	21,800	25,350
Price per hundredweight	$5.80	$5.40	$5.40	$5.84	$5.40	$6.20	a	a	a
Value ($1000)	1,958	2,095	2,398	293	259	391	2,251	2,354	2,789

Source: United States Department of Agriculture, Vegetable-Processing and Vegetable-Fresh Market, 1963 Annual Summaries (Washington: Government Printing Office, December 1963), pp. 14-15, 20-21, respectively.

[a]Data not given.

The statistics clearly indicate that the Tennessee snap bean processing industry has been expanding in recent years. A study of the consumption pattern of snap beans for the United States shows that total per capita consumption of snap beans increased sharply during the World War II period, while the per capita consumption of fresh snap beans has declined from 4.8 pounds in 1938 to 2.2 pounds in 1963. During the same period, the per capita consumption of canned snap beans increased from 1.5 pounds in 1938 to 3.24 pounds in 1963. Consumption of frozen snap beans increased from .06 pounds per capita in 1938 to 1.11 pounds in 1963. Total consumption of snap beans per capita has increased from 6.36 pounds in 1938 to 6.55 pounds in 1963 (Figure 5).

When the consumption data are fitted on a figure using the average per capita consumption of fresh, frozen and canned snap beans with 1938-63 as the base, the picture becomes much clearer, as is shown in Figure 6. The total per capita consumption increased from 94.1 per cent in 1938 to 96.9 per cent in 1963. Per capita consumption of fresh snap beans decreased from 127.8 per cent in 1938 to 58.6 per cent in 1963. The only time per capita consumption of fresh beans did show a gain was during World War II, the three postwar years, and 1953, the last year of the Korean War. Per capita consumption of canned snap beans increased from 61.0 per cent in 1938 to 131.8 per cent in 1963.

The per capita consumption of frozen snap beans has been increasing rapidly. The per capita consumption increased from 11.0 per cent in 1938 to 204.4 per cent in 1963. Figure 6 shows that the rate of change

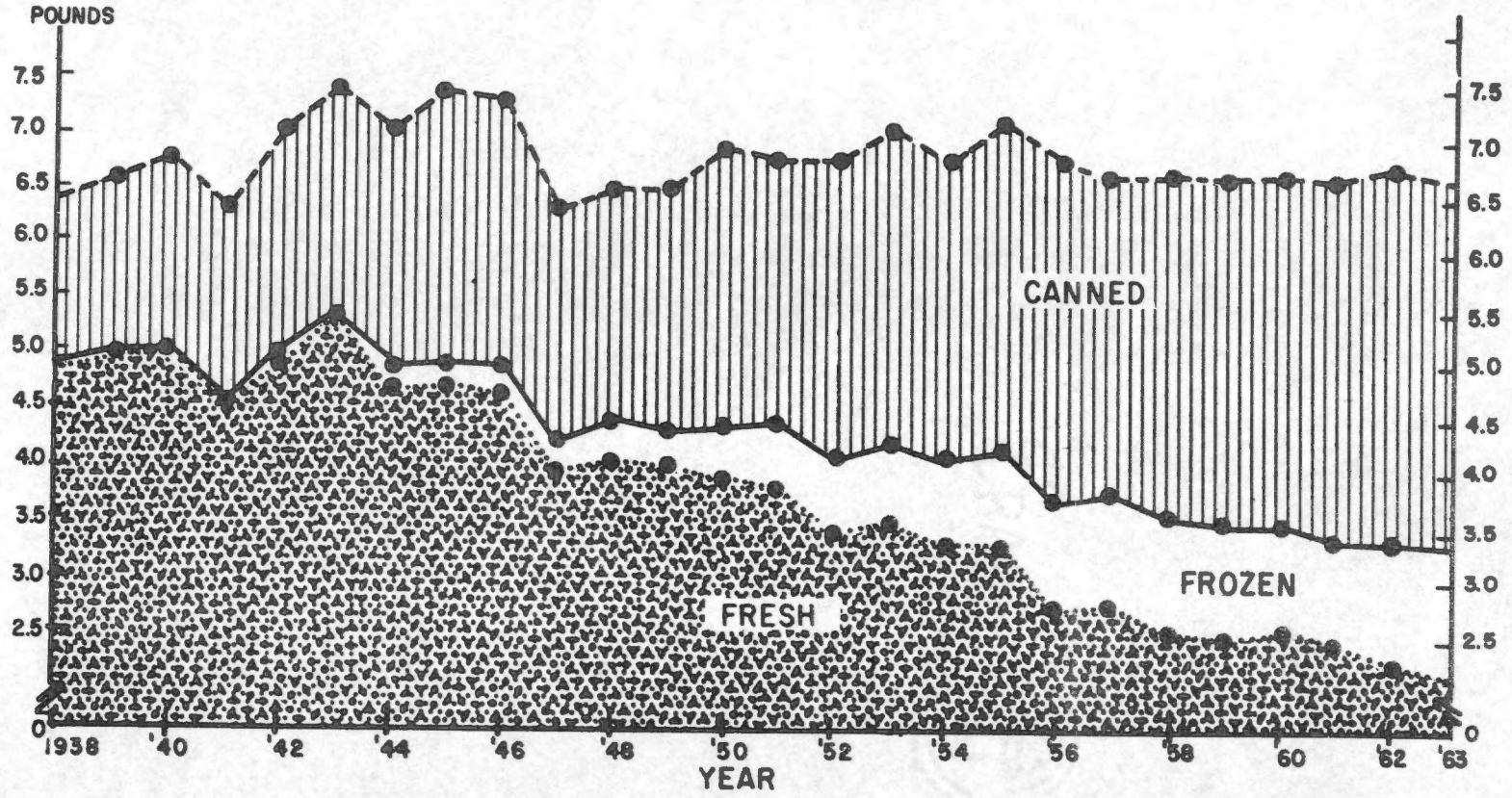

Figure 5. Per capita consumption of snap beans: fresh, canned and frozen, United States, 1938-63.

Source: United States Department of Agriculture, Vegetable Situation 1965 Outlook Issue (Washington: Government Printing Office, October 1964), p. 23.

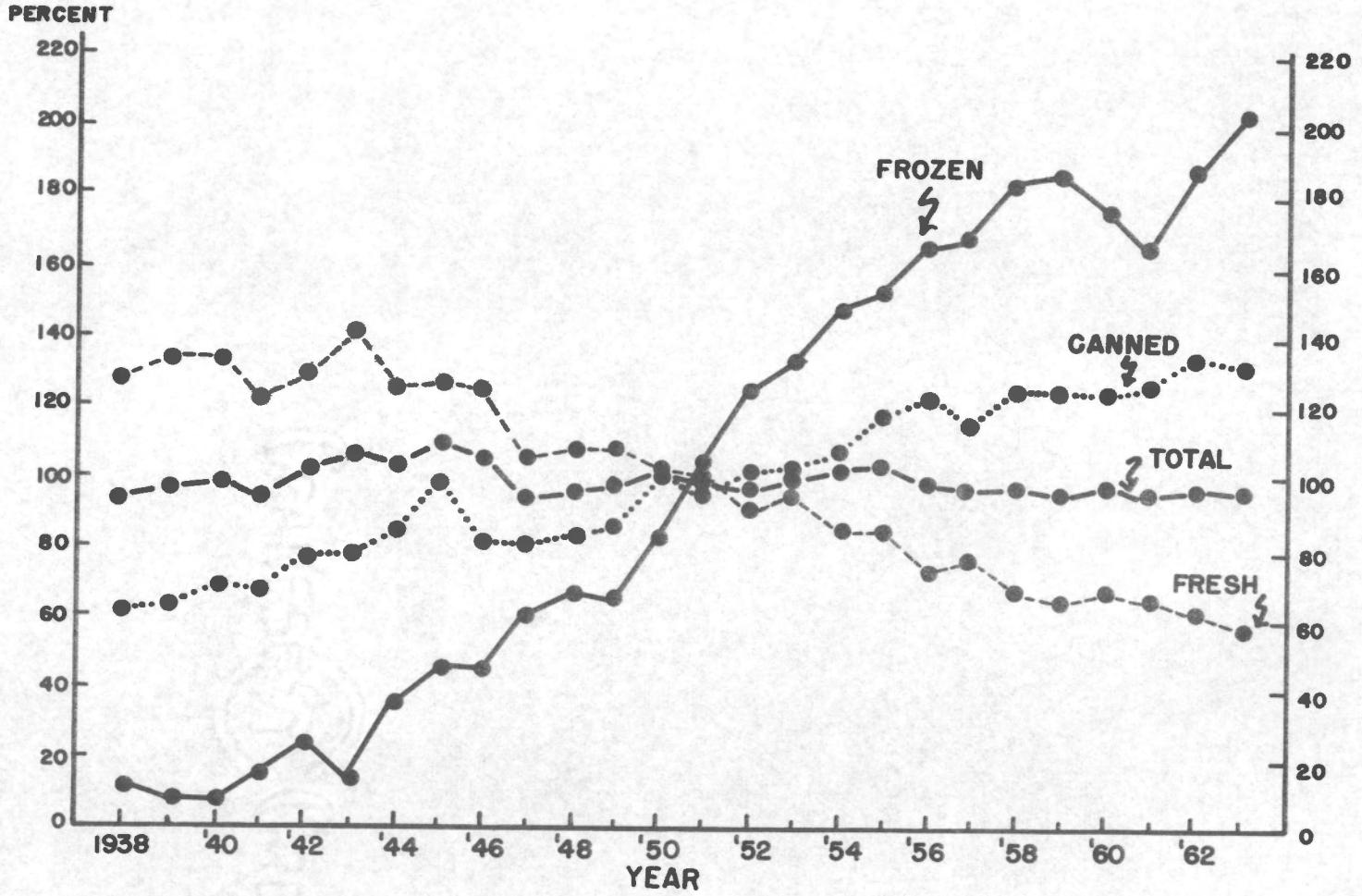

Figure 6. Relative change in the per capita consumption of fresh, canned and frozen snap beans, United States, 1938-63.

Source: United States Department of Agriculture, Vegetable Situation 1965 Outlook Issue (Washington: Government Printing Office, October 1964), p. 23.

in per capita consumption of frozen snap beans is increasing at a faster rate than the per capita consumption of canned snap beans. An increase in demand for frozen snap beans justifies the expansion of processing facilities in Tennessee.

Of the 44,400,000 pounds of snap beans processed in Tennessee during 1963, the quantity processed by freezing in Tennessee was 17,918,185 pounds. Of all the beans grown in Tennessee for processing, 35.4 per cent was frozen compared with 26.6 per cent of the total pounds processed in the United States (Table III, p. 11).

Most of the past and current research in snap bean processing in the United States has been chiefly for the benefit of canners. This emphasis can be justified because they do 75 per cent of all processing. In Tennessee, with 48.35 per cent of the snap beans being frozen, there is a great need for research that would benefit the freezers. The quality of the snap beans processed by freezing and the convenience of purchasing them in packaged form appeal to the housewife. For these reasons, the trend in per capita consumption should continue to rise.

As a result of being a part of the snap bean freezing industry in which demand in increasing, the Tennessee freezers need information on increasing the efficiency of their processing operations. If the Tennessee processors are to maintain their competitive position, they must have this information to make decisions on a sound basis. It is hoped that the findings of this study will assist in planning for future operation of the snap bean freezing plants.

III. OBJECTIVES OF STUDY

The objectives of this study were:

1. To determine the costs of processing snap beans for freezing in four existing plants.

2. To design model plants for processing snap beans for freezing at least cost.

3. To determine how the costs vary in model plants according to plant size, less than capacity operation, length of season, size of container, and per cent of recovery.

4. To evaluate the relative efficiency of processors freezing snap beans in Tennessee.

Model plants provide a means of reducing costs by incorporating information from existing plants. It is hypothesized that models developed in this study may provide a means for processing under least-cost conditions by evaluating the important factors associated with the costs of processing, namely: plant size, length of season, capacity of operation, size of container, and per cent of recovery. It is possible to evaluate the relative efficiency of the plants processing snap beans for freezing in Tennessee by making direct comparisons with the model plants which have been developed.

IV. ANALYTICAL PROCEDURE

Accounting records for each plant served as a source for the various cost components. Interviews with management personnel, plant

foremen, mechanics, and other workers furnished information for determining a number of inputs as well as the output potential for various employees and pieces of equipment. The equipment manufacturers also provided information on the output capacity for each major piece of equipment and processing equipment layouts. Building requirements were determined from actual observations. Engineering data from previous studies were used in determining input requirements for water, electricity, and gas.

Production standards were established for jobs which were performed in a distinct and determinable manner. Individuals were observed as they operated under normal conditions or adjusted normal conditions. A 15 per cent allowance was made for rest periods where standards involved a worker. A 10 per cent allowance was made for equipment break-down where the standards involved a piece of equipment.

The assumption is made that average variable costs are constant for all plants even though they have varying rates of output. With this assumption total output is adjusted by varying the hours of operation since it is not feasible to adjust total output by varying the rate of output per hour.

Two analyses were performed in this study:

1. The identities of the existing plants were retained. All of the variable and fixed costs were standardized with the analysis being conducted on the plants to determine the costs for each plant under present conditions. The assumption of constant average variable costs is relaxed for the cost calculations.

2. Model plants were constructed, and all of the variable and fixed costs were standardized. Five of the factors which affect the cost per pound in model plants were analyzed. These factors were: (a) plant size, (b) length of season, (c) capacity of operation, (d) size of container, and (e) per cent of recovery. The assumption of constant average variable costs is relaxed for the cost calculations.

V. EXISTING PLANTS

The four existing snap bean freezing plants in Tennessee had varying input capacities, rates of output, length of season, degrees of mechanization, and general processing procedures, and accounting systems.

The cost analysis for the existing plants was made on the basis of variable, fixed, and total costs. Freezing and storage costs were standardized at 35 cents per 100 pounds. This rate, charged by a commercial freezing and storage firm, included only the first month's storage. An additional 10 cents per 100 pounds was included to cover the standardized in-plant transportation costs. Brokerage fees, which are usually about 5 per cent of selling price, were standardized at 70 cents per 100 pounds. Utilities (electricity, water, and gas) were standardized on the Knoxville Utilities Board rates for commercial customers (see Appendix C). An added variable cost, miscellaneous general expense, was included and standardized at $11,425 for all firms in both

TABLE V

SIZE AND COST OF CONTAINERS USED FOR PACKAGING SNAP BEANS PROCESSED FOR FREEZING IN TENNESSEE, 1963

Size of container	Cost per 1000
Retail (9 ounce carton)	$ 6.62
Retail (9 ounce wrap)	5.50
Retail cases (15 pound)	70.00
Institutional (2½ pound carton)	17.50
Institutional (2½ pound wrap)	7.50
Institutional cases (30 pound)	90.00
Polybag (20 ounce)	71.00
Polybag cases (15 pound)	64.00
Bulk bags (60 pound)	132.95

analyses (Table XXXI, page 110). The container costs were standardized as shown in Table V.

The standardized wage rates for each classification of labor were as follows:

Plant manager	$12,000 per year
Plant superintendent	$ 7,000 per year
Bookkeeper	$ 7,000 per year
Secretary	$ 3,500 per year
Clerk-typist	$ 2,800 per year
USDA inspector	$ 6.00 per hour
Foreman	$ 1.40 per hour
Mechanic	$ 2.50 per hour
Plant workers	$ 1.25 per hour

The payroll included withholding taxes in the amount of 6.575 per cent. The total was composed of 3.875 per cent FICA and 2.700 per cent for Tennessee Unemployment Insurance.

VI. MODEL PLANTS

The model plants were developed from observation of existing plants and a study of equipment manufacturer's layouts, with an attempt made to incorporate any new methods or procedures which were thought to make the plants more efficient. Ideal plant layouts were necessary to provide a means for processing at least cost. To meet the objectives of this study, model plants were formulated for the purpose of conducting

five separate analyses.

The model plants and each analysis are:

1. Ten model plants were constructed with the following raw input capacities of 2,000, 4,000, 6,000, 8,000, 10,000, 12,000, 14,000, 16,000, 18,000 and 20,000 pounds per hour.

2. Hours of plant operation per season were based upon eight-hour shifts for one and two shifts per day over a total of 100 processing days on Tennessee beans. The analysis was extended to include a possible 25 days of processing Florida beans during early spring and late fall. The lengths of season, covering a range of 800 to 2,000 hours, were used to evaluate the influence of different lengths of operating season.

3. Operating capacity was analysed at 50, 75, and 100 per cent to determine the associated processing costs for the corresponding output. When a plant operating 800 hours was analyzed at 50 per cent capacity, it was handled as operating 400 hours at full capacity in establishing the associated costs.

4. Cost for each pack was based upon the following sizes: (a) retail (9 ounce), (b) institutional (2½ pound), (c) bulk (60 pound), and (d) polybag (20 ounce).

5. The per cent of recovery or pack out for the model plants was standardized at 75 per cent. The recovery percentage directly affects the portion of total cost composed of raw product cost. The effects of pack out were evaluated at 50, 60, 70, 75, 80, 90 and 100 per cent recovery.

VII. REVIEW OF LITERATURE

A number of studies have been conducted to estimate input-output data and costs for firms processing agricultural commodities. These previous studies provide a basis or guideline for conducting this analysis and explaining the existing conditions.

Firms operate at less than maximum efficiency for two reasons. Once a firm has already incurred a substantial investment in a piece of equipment, it will adopt new technologies only if the new innovation will drastically reduce cost or if the older piece of equipment wears out and has to be replaced. Lack of information on new technologies may be a major deterrent to the achievement of maximum efficiency.[6]

In arriving at a decision as to the plant size and methods of operation, the manager is faced with two kinds of uncertainty: future possibilities for the product being processed and the factor prices. A manager must be cost-conscious since he needs to know what it will cost to replace and maintain durable items in the plant.[7]

According to Logan and King, any plant with several stages or operations in a processing line will also have a variety of production capacities at varying points. The point where production capacity is least will prove to be a bottleneck for output in the plant. Excess capacity will exist at all other points on the processing line.[8]

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[6]French, op. cit., p. 544.

[7]Ibid., p. 577.

[8]Samuel H. Logan and Gordon A. King, Economies of Scale in Beef Slaughter Plants, Giannini Foundation Research Report No. 260, California

In a study on economies of scale in commercial egg packing plants, it was noted that large scale production does not necessarily lead to economies. Some of the plants actually may have diseconomies due to increasing costs related to increased sizes. Some of the plants may have neither economies or diseconomies, and they make decisions on the basis of constant costs.[9]

In a similar study conducted in California on the multiple product processing of California frozen vegetables, the equipment requirements were developed from production studies, plant operating data and equipment inventories, specifications of manufacturers, and interviews with specialist personnel in freezing plants and equipment companies. Engineering data for building requirements were obtained from actual observation. Labor requirements and other input information were obtained or estimated from plant records, observations of plant organization, and consultation with plant operators.[10] Dennis, in a study on the cost of processing strawberries for freezing, used much the same

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Agricultural Experiment Station (Davis: University of California, September, 1962), p. 9.

[9]Harold B. Jones, Economies of Scale in Commercial Egg Packing Plants, Bulletin No. 120, United States Department of Agriculture, Marketing Economics Division, Economics Research Service in cooperation with Georgia Agricultural Experiment Station (Athens: University of Georgia, September, 1964), p. 11.

[10]Robert H. Reed and L. L. Sammet, Multiple Product Processing of California Frozen Vegetables, Giannini Foundation Research Report No. 264, California Agricultural Experiment Station (Davis: University of California, July, 1963), pp. 23-24.

type of approach for establishing costs for the plants.[11]

Reed, in a similar study on processing of lima beans for freezing, defined variable costs to include expenses for labor, materials, electric power, variable repair costs, and other expenses directly related to volume of output.[12]

According to a study of plants pasteurizing and bottling milk, plant operators were found to analyze their operations by making calculations for a proposed change in their plants and comparing the results with existing costs. They used a type of budgetary analysis. In establishing model plants, a budgetary analysis is very useful. If the plants are set up in a workable and functional way, the results obtained from the model plants may be useful to plants that are actually processing.[13]

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[11] Carleton C. Dennis, An Analysis of Costs of Processing Strawberries for Freezing, California Agricultural Experiment Station Mimeographed Report No. 210 (Berkeley: University of California, July, 1958), pp. 2-3.

[12] Robert H. Reed, Economic Efficiency in Assembly and Processing Lima Beans for Freezing, California Agricultural Experiment Station Mimeographed Report No. 219 (Berkeley: University of California, June, 1959), p. 3.

[13] M. C. Conner, Fred C. Webster and T. R. Owens, An Economic Analysis of Model Plants for Pasteurizing and Bottling Milk, Virginia Agricultural Experiment Station Bulletin 484 (Blacksbrug: Virginia Polytechnic Institute, June, 1957), pp. 3-4.

CHAPTER II

DESCRIPTION OF EXISTING PLANTS AND OPERATIONS

Snap bean freezing plants in Tennessee do not follow a set pattern. Procedures and operations are varied in each plant with no two plants necessarily employing the same technique. To better explain the snap bean processing operation, a descriptive analysis of the existing plants is included at this point. The plants will be identified as A, B, C and D.

I. VOLUME OF PRODUCT

Of the plants processing snap beans, no plant is involved in a single-product operation. Although snap beans account for a major part of the plants' volume, they do process other products. The snap bean freezing plants did not become firmly established until the 1960 processing season or later. One of the four plants was placed in operation during 1963, while another plant expanded its facilities in 1963 by relocating in a new building. From 1960 to the present, the total pack each year has been increasing. Although the plants are engaging in multiple product processing, the expansion in the volume of snap bean processing has been responsible for a reduced pack of other products.

A complete list of the vegetables packed and of the volume of pack for each plant freezing snap beans in Tennessee is provided in

Table VI. A total of 40,048,077 pounds of vegetables was frozen in Tennessee during 1963. Snap beans accounted for 21,121,352 pounds or 52.73 per cent of the pounds frozen. The second closest competitor was okra with 7,363,376 pounds, 18.38 per cent of the total pounds frozen. Greens (kale, collards, spinach, turnip greens, mustard greens, green turnips) were 8.78 per cent of the total pack with a total of 3,517,168 pounds. Strawberries, peas, pepper, squash, repacks, and small quantities of other vegetables were also frozen, and accounted for the remaining 20.11 per cent.

The leading plant in processing snap beans was Plant D, which packed more than half of the aggregate 21 million pounds. Plant D also led in the processing of strawberries. Plants A and B processed more pounds of other products than did Plant D.

All of the beans processed are not from Tennessee, as is shown in Table VII. Of the 21 million pounds of snap beans processed for freezing, 84.83 per cent was grown in Tennessee. The other 15.17 per cent was grown in North Carolina, South Carolina and Florida. Eighty-six per cent of the snap beans for the four plants was produced under contract or vertical integration; one plant had 100 per cent of its beans grown under contract.

II. LENGTH OF SEASON

The length of the processing season in Tennessee can be varied from a limited number of hours to a large number by operating two shifts,

TABLE VI

POUNDS OF VEGETABLES PROCESSED BY PLANTS FREEZING SNAP BEANS, TENNESSEE, 1963

Product	Plant A	Plant B	Plant C	Plant D	Total
			-Pounds-		
Snap beans	600,000	5,704,173	2,805,640	12,011,539	21,121,352
Strawberries	400,000	158,621	269,420	2,315,850	3,143,891
Greens (turnip greens, collards, mustard greens, green turnips, kale, spinach)	0	385,276	3,131,892	0	3,517,168
Peas	0	903,369	0	0	903,369
Pepper	0	103,388	0	0	103,388
Squash	0	573,035	0	0	573,035
Okra	5,000,000	2,363,376	0	0	7,363,376
Other vegetables	0	0	0	3,322,498	3,322,498
Total	6,000,000	10,191,238	6,206,952	17,649,887	40,048,077

TABLE VII

POUNDS OF SNAP BEANS PROCESSED PER PLANT IN TENNESSEE, AMOUNTS OBTAINED FROM TENNESSEE AND FROM NORTH CAROLINA, SOUTH CAROLINA AND FLORIDA, 1963

Plant	Processed per plant	Source			
		Tennessee		N. C., S. C. and Fla.	
	Pounds	Pounds	Per cent	Pounds	Per cent
A	600,000	540,000	90	60,000	10
B	5,704,173	5,704,173	100	0	0
C	2,805,640	2,665,358	95	140,282	5
D	12,011,539	9,008,654	75	3,002,885	25
Total	21,121,352	17,918,185	84.83	3,203,167	15.17

and by processing out-of-state beans during Tennessee's off season. Table VIII shows how the days of processing varied among plants during the 1963 season. The Tennessee snap beans are ready for processing about June 15-June 25, and they are in supply up until the first frost each fall, about October 10.

If the processors desire to extend the season, they may use snap beans from Florida, South Carolina, North Carolina, and other states in the Southeast. Processing can begin in early March and continue at intermittent periods in April. Enough beans can be obtained in May and June to assure continuous processing operations until the Tennessee beans are ready for harvest. Table VIII shows that the days of processing in 1963 varied from a low of 70 to a high of 173. The plant operating for 173 days obtained about 25 per cent of its beans from Florida, North Carolina, and South Carolina. It is not always possible to obtain snap beans from states outside of Tennessee because the beans may be in short supply in those areas. Also, the processors in Tennessee are located about 600 miles from these out-of-state producers, and this poses some economic and physical problems. A relatively high transportation cost is incurred for ths long haul. The physical problem occurs because measures must be taken to eliminate oxidation and dehydration of the snap beans while they are in transit.

Hours of plant operation each day varied from 8-10 hours per shift up to two shifts per day. The minimum number of two-shift days operated by any plant was 20, and the maximum was 80. An existing potential for expanding total output lies in extending the hours of operation.

TABLE VIII

LENGTH OF SEASON FOR PROCESSING SNAP BEANS BY FREEZING IN TENNESSEE PLANTS DURING 1963

Plant	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total days operated	Number of days operating 2 shifts
A			---			---	-----	-----	-------	---	---	----	173	80
B			---			---	-----	-----	----	-	---	-	90	20
C						---	-----	-----	------	-------	--		120	40
D						---	-----	-----	------	-----			70	30

This is a source of flexibility for the plants. Regulations permit the processing plants to operate 13 weeks with unlimited hours; 13 weeks with up to 56 hours per week; and any weeks of operation beyond the first 26 weeks necessitate the payment of overtime for all hours over 40. If the plants attempt to operate beyond 26 weeks, they immediately encounter a higher cost per unit of product because of the necessity of overtime payment if the hours of operation extend beyond 40 per week. The plants currently processing do not encounter this situation because their operating season does not place them in this category.

III. PRODUCTION AREAS IN RELATION TO PROCESSING PLANTS

The snap-bean-producing centers are located in four areas of the state (Figure 7). All of the counties in Tennessee are not climaticly adapted to the growing of snap beans. Of the 11,100 acres harvested for processing in 1963, approxiately 600 acres were in Area I; 8,400 acres in Area II; 400 acres in Area III; and 1,700 acres in Area IV. Area II is particularly well adapted to production.

Since the mechanical harvesters for snap beans were introduced, Area II has become the center for producing snap beans. Mechanical harvesters can operate over the terrain in Area II without any difficulty. It is almost impossible for mechanical harvesters to operate to any extent in Area IV.

There are five canning plants and four freezing plants processing snap beans in Tennessee. The canning plants are concentrated in the

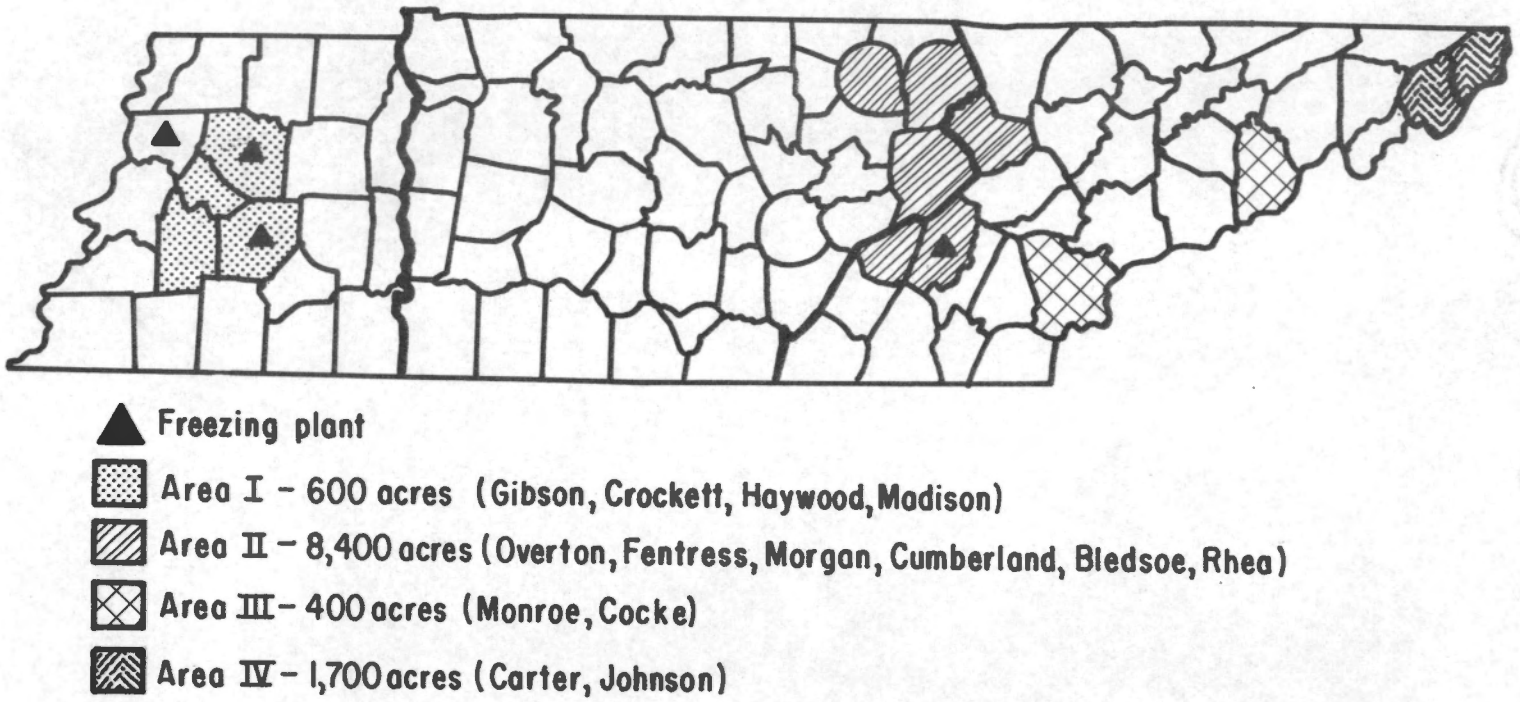

Figure 7. Location of counties producing snap beans for processing and location of snap bean freezing plants in Tennessee, 1963.

Eastern division of the state, and the freezing plants in the Western division. One freezing plant is located in East Tennessee (Figure 7).

Although only 600 acres of snap beans are being produced in Area I, because of its high summer temperatures, there are three freezing plants located there. Consequently, these plants have to purchase a large percentage of their beans from Area II, which is 275-300 miles away. The largest snap-bean-freezing plant is located in Area II, and practically all of the Tennessee beans that it processes are from the immediate area.

IV. OPERATIONS IN PROCESSING

Before discussing the operations which are used in processing snap beans for freezing, it is necessary to describe the raw product classification. Snap beans for freezing are classified as U. S. Grade A (U. S. fancy), U. S. Grade B (U. S. extra standard), U. S. Grade C (U. S. standard), and substandard.[1] The beans are classified into six sieve categories. According to the Chisholm-Ryder machinery specifications, the sieve categories are: No. 1--14½/64 inch or less in diameter; No. 2--18½/64 inch; No. 3--21/64 inch; No. 4--24/64 inch; No. 5--27/64 inch, and No. 6--greater than 27/64 inch. The No. 6 classification corresponds with the existing processing procedure in local plants.

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[1] United States Department of Agriculture, Agricultural Marketing Service, Marketing Information Division, Grade Names, Agriculture Handbook No. 157 (Revised) (Washington: Government Printing Office, February, 1961), p. 11.

Snap beans of sieve sizes No. 1 and 2 are packed as whole beans if a plant produces that type of pack. Sieve sizes No. 1, 2, 3, and 4 are usually crosscut in the processing operation. French slice beans usually come from sieve sizes No. 4, 5, and some of the 6. If the No. 6 sieve beans are too large, as they may very well be, they are discarded as waste. When the No. 6 beans are used, they must be for the French slice pack.

As the snap beans are received at the processing plant, they are graded in some manner usually for the purpose of determining the price to pay the producer. The grading may be done by a method of visual inspection or by a more complicated and scientific approach. When the beans are unloaded at the plant, they are ready to enter the processing operations.

Trash Removal

When the beans are brought in from the field, they are usually dirty, especially if they have been mechanically harvested. They quite often contain chunks of dirt or even some foreign objects such as stones. It is necessary to break any clusters so that the beans will enter the lines as individual beans. Dirt and small pieces of trash are removed by some type of centrifugal blower. At or near the time of washing the beans, it is necessary to remove only large pieces of trash such as small stones or other objects. If the stones and other foreign objects were permitted to reach the delicate processing equipment, serious damage would be inflicted upon the equipment. Manual inspection of the

beans can be performed before snipping, but it is not absolutely necessary.

Grading, Snipping and Inspection

Plants which pack a diversified product use a pregrader. A double-size grader may be used in the operation to further break down the sieve sizes for diversification of pack. Where beans are packaged as either cut or sliced, only one machine-grading operation is needed. Two gradings are necessary when the No. 1 sieve size is separated out for a whole-bean pack. Immediately after the beans are size-graded, the snipping machines remove or snip any string or stem. An inspection belt follows each snipper and, at this point, diseased or poor quality beans are removed by hand. If any stems are left after snipping, they are hand snipped on the inspection belt.

Cutting and Blanching

Snap beans which are to be cut pass from the inspection belt into the cutters. Here, the beans are crosscut. Then they go through a nubbin grader where the small fragmentary parts drop out, and only the uniform cuts move on to the blancher. The blanching operation is a partial cooking process which serves the purpose of deactivating enzymes so that the beans will not spoil in the package.

Cooling, Dewatering and French Slicing

It is necessary to cool the beans after they leave the blancher. They are exposed to either a water bath of some form of spray to

complete the cooling process. The snap beans then pass through a dewatering device, which is usually a simple shaker designed to remove excess water. Snap beans which are to be sliced then pass through the slicing machine, where the beans are slit lengthwise into long, narrow slices.

Packaging

The packaging operation is virtually the same regardless of whether the beans are sliced, crosscut, or whole. Sliced snap beans cannot be channeled through an automatic filler as successfully as the crosscut beans.

Some of the cut and whole beans may pass directly from the dewatering device into a holding tray. These beans are transferred immediately into the tunnel, where they are kept for a period of 4 hours at -40°F. These snap beans are frozen as Individual Quick Frozen (IQF). After being removed from the tunnel, these beans may be bagged in bulk containers for repacking at a later date, or they may be packaged immediately upon removal.

Snap beans are packaged in two major types of cartons: retail and institutional. The retail cartons are of three distinct sizes: 8, 9 and 10-ounce. The institutional cartons may contain 2, 2½ and 3 pounds. The IQF beans may be bagged in bulk bags of various sizes. A 60-pound bag is most commonly used by Tennessee processors. Some of the snap beans (IQF) are not being packed in polyethelene bags, which are transparent and contribute to an attractive pack. Polyethelene

bags may vary in size, with the 16- and 20-ounce bags being very popular at the present.

The packaging operations consist of filling the cartons either by hand or automatically. After the cartons are weighed automatically, those which are overweight or underweight are removed from the line. The weight is adjusted manually before the cartons are placed back on the packaging line. The cartons are closed automatically and then wrapped by machine. All beans other than the IQF's must be transferred to the tunnel, where they are left for four hours at a -40°F.

As soon as the cartons are removed from the tunnel, they are cased and transferred to cold storage (approximately -20°F) until they are ready for distribution.

V. OPERATIONAL ANALYSIS OF EXISTING PLANTS

The operational procedure for the four plants freezing snap beans in Tennessee is shown in the flow charts given in Figures 8, 9, 10 and 11. Each flow chart is self-explanatory, but special attention needs to be given to the fact that operations and procedures vary from plant to plant.

When the beans were received at the plants, there were three different methods of unloading: manually with a pitch fork, dumping directly from the truck into a large holding bin, and by a winch-powered pitch fork.

Since one of the plants did not use a cluster breaker, their inspectors performed this operation after the snippers. Some trash

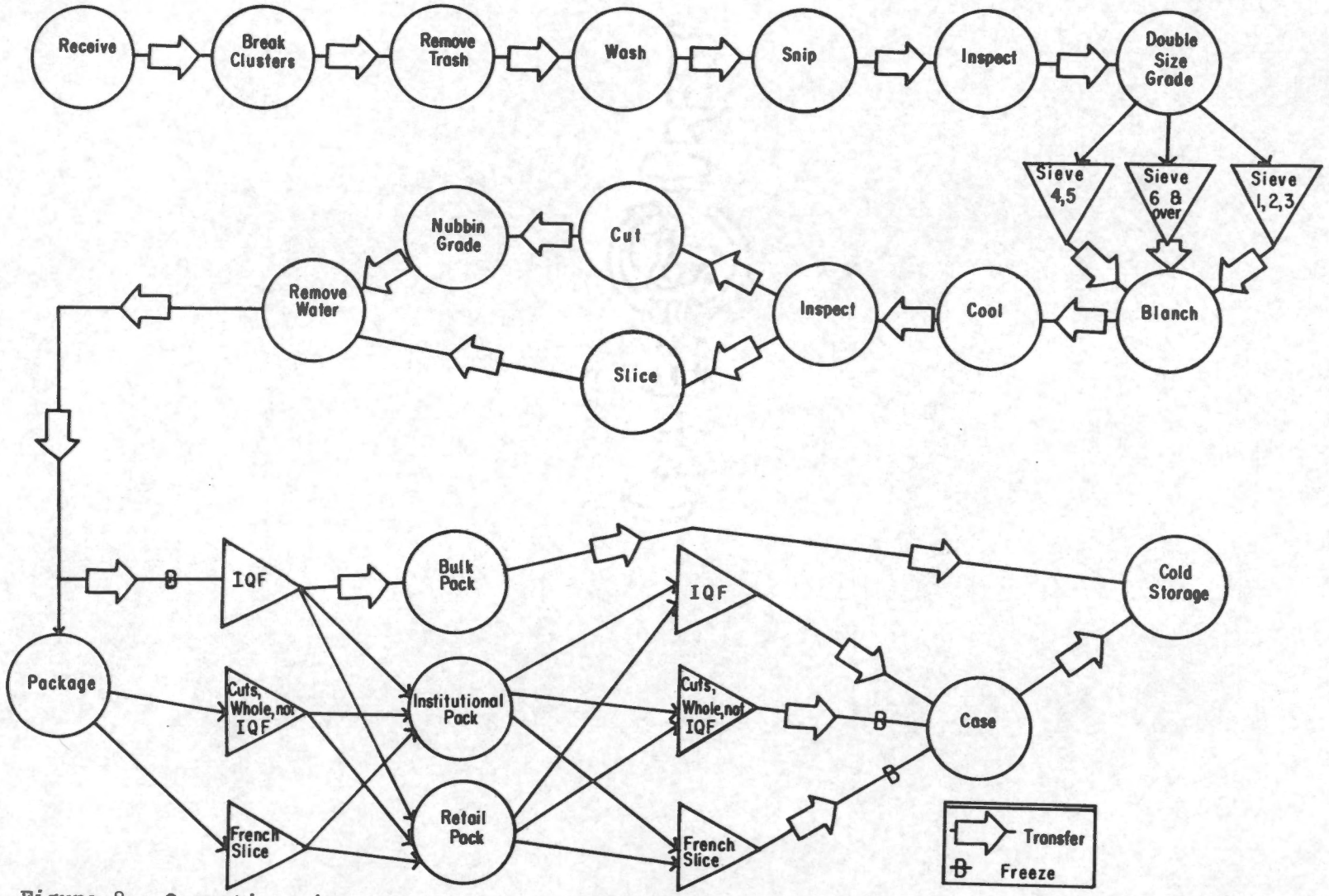


Figure 8. Operations in processing snap beans for freezing in Plant A, Tennessee, 1963.

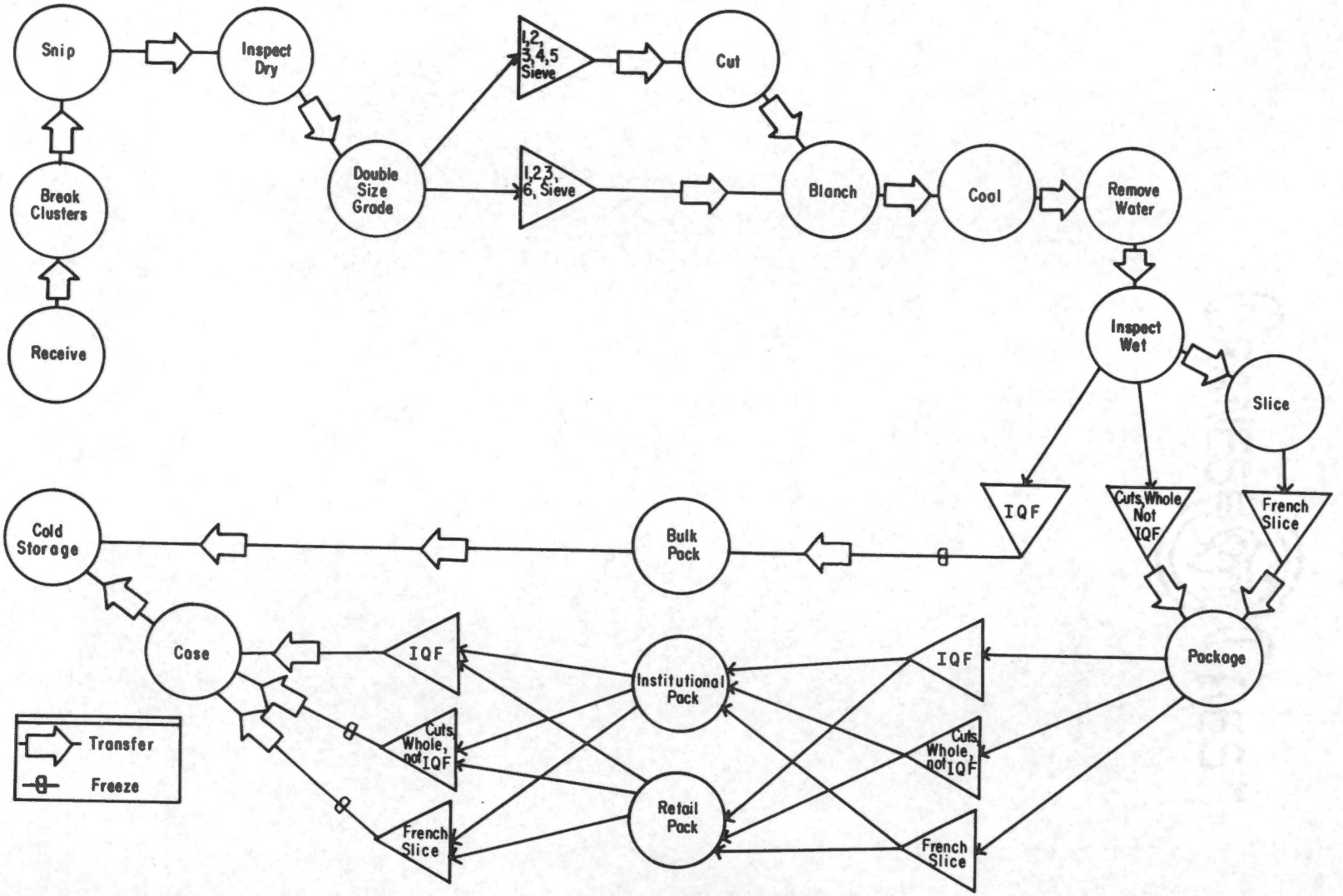


Figure 9. Operations in processing snap beans for freezing in Plant B, Tennessee, 1963.

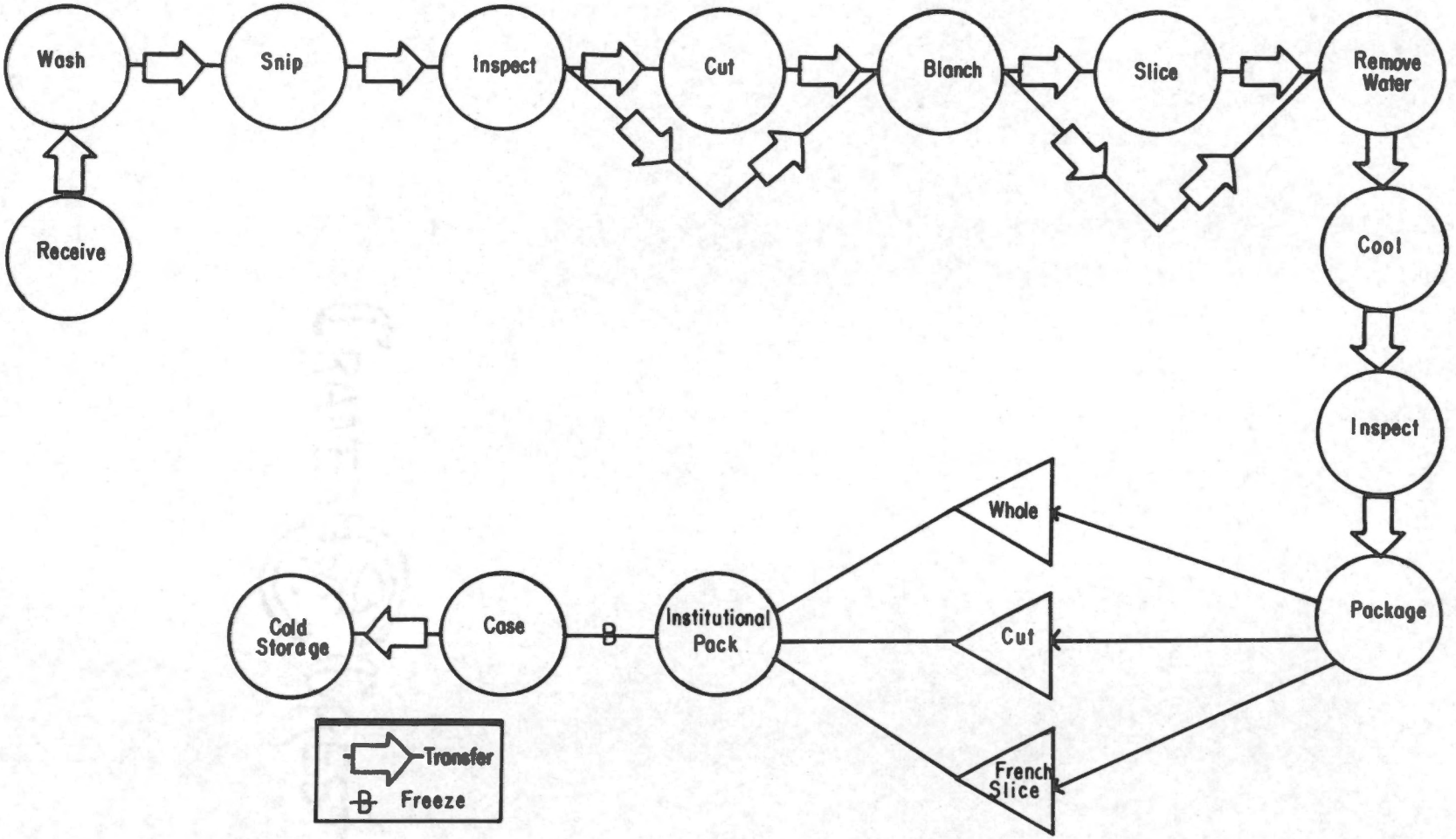


Figure 10. Operations in processing snap beans for freezing in Plant C, Tennessee, 1963.

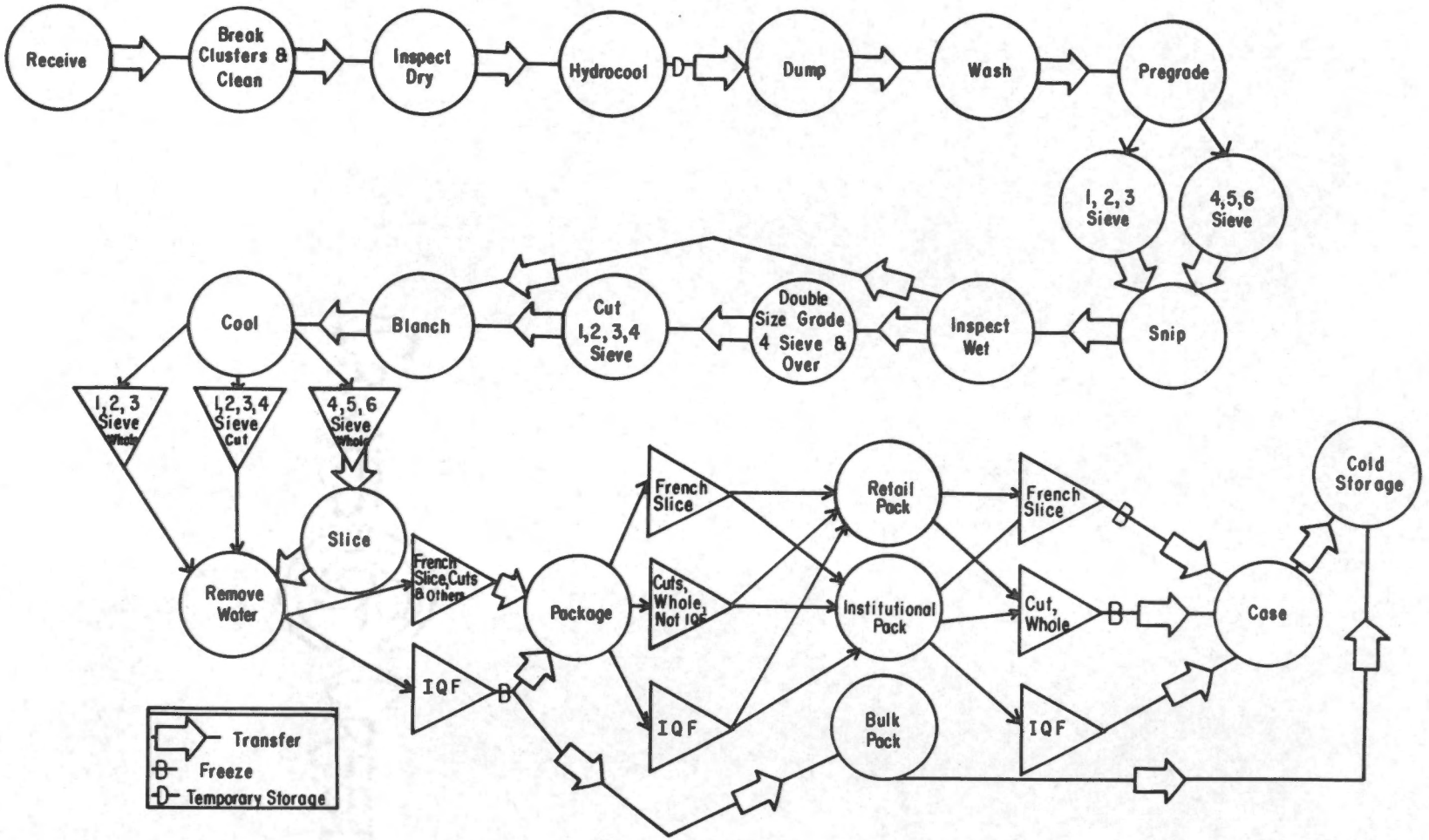


Figure 11. Operations in processing snap beans for freezing in Plant D, Tennessee, 1963.

removal took place at the cluster breaker by a centrifugal blower. At one of the plants, the beans were not washed until they were enroute to the blancher. The beans were washed at the other three plants before they were snipped.

At one plant, a form of dry inspection was conducted before the beans were snipped. At another plant, the beans were cooled by a water spray. After this, they were placed in cool storage before being conveyed to the next processing operation. The hydro-cooled beans can be left in cool storage for several hours before being moved into the processing operation.

Three of the plants had no form of pregrading before the snippers, although two did have double-size graders following the snipper and inspection belts. The double-size grader and pregrader were used in combination by one plant in which a diversified product was packed.

All plants had an inspection immediately following the snippers. Only one plant had an inspection following the blanching process. One plant crosscut its beans after the blanchers, whereas all others performed this operation before the blanchers. In all of the plants, the slicing operation was performed after blanching and cooling was done.

Different methods of packaging were employed in the plants because of the different degrees of automation. Some of the plants filled their institutional cartons by hand, whereas others used automatic fillers. Usually the cartons had to be closed by hand if no automatic filler was used. A large quantity of labor was necessary for packaging when

most of the operations were performed by hand. Different methods were employed in all plants for bulk bagging, polybagging, and casing; but the major difference was due to the degree of automation employed.

CHAPTER III

COSTS OF PROCESSING SNAP BEANS FOR FREEZING IN EXISTING PLANTS

The four plants processing snap beans for freezing in Tennessee during 1963 were different in processing capacity, utilization of processing capacity, length of season, degree of mechanization, and general processing procedures. Any or all of these variations could substantially affect the costs of processing. In order to determine the exact reasons for cost variations from plant to plant, it is necessary to appraise the factors affecting cost in each of the four plants and to show how the cost differed from plant to plant.

The data shown in Table IX are presented for a period of two years in order to make possible a complete study of all plants concerned. Table IX differs from Table VII, page 30, in that the total pounds processed from Plant A and Plant B are for the 1964 processing season. All of the cost analysis was based on the input-output information given in Table IX.

Recovery or pack out is a very important item to the processor because it directly affects the total cost of processing when the raw product cost is added to the processing cost. The percentage of pack out will be analyzed in the model plants included in Chapter IV. Recovery for the existing plants ranged from 69.88 per cent for Plant A

TABLE IX

VOLUME OF SNAP BEANS PROCESSED, OUTPUT, AND PER CENT RECOVERY IN PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963 AND 1964

Plant	Total pounds processed	Total pounds output	Recovery (per cent)
A	4,489,610[a]	3,137,307	69.88
B	4,020,341[a]	2,840,648	70.66
C	2,805,640	2,227,120	79.38
D	12,011,539	9,366,598	77.98
Total	23,327,130	17,571,673	75.33

[a]Total pounds processed are for the 1964 processing season.

to 79.38 per cent for Plant C, as is shown in Table IX. The average recovery percentage for the four plants was 75.33 per cent.

A number of factors may affect the recovery percentage. If the beans are damaged by insects or diseases, it is necessary to sort them. When beans are machine-picked, they will contain more trash, dirt, and clusters than will hand-picked beans. As machine-picked beans are cleaned at the plant, this trash and foreign material is removed. Another factor affecting recovery is the distance from the field to the processing plant. Beans that are in transit for several hours are more likely to deteriorate because of disease, heat, and other factors. This will necessitate a higher per cent sort-out than would have been necessary if the beans had been processed within a relatively short time after picking. A higher percentage of recovery is possible if the processor is not striving for a Grade A pack because the percentage of sort outs will be less for Grades B and C. Furthermore, if the processing equipment is not set up efficiently, some good-quality beans will be wasted.

The recovery percentages shown in Table IX tend to support the above observations. Plants A and B, which had the lowest recovery percentages, were located approximately 300 miles from the producers and the operators tried to process either a Grade B or Grade A product. These two plants also processed machine-picked beans. Plant C, which had the highest recovery percentage, was also located about 300 miles from the producers, but only hand-picked beans were processed. Also, this plant packaged Grades B and C beans; no attempt was made to pack

Grade A beans. Plant D was located within 20-40 miles of the producers, and only machine-picked beans were processed. The percentage of recovery might have been even higher for this plant, but it packaged mostly Grades A and B.

The four major types of containers packaged by plants processing snap beans for freezing were retail, institutional, polyethelene bags, and bulk. The sizes of each of these containers may vary as can be seen in Table X. Not all of the plants packed whole beans. When whole beans were packed, it was necessary to have flexibility within the processing and packaging equipment. A complete breakdown by size for each of the major types of containers was not available for Plant B. There is no pattern on the percentage packaged by the type of container. It is noted that the smallest plant, which was Plant C, packaged only cut beans in two types of containers, institutional and bulk. In the four plants, 38.03 per cent of the beans packaged were in retail cartons and 32.28 per cent were in institutional cartons. A total of 10.19 per cent was packaged in polyethelene bags and 19.51 per cent in bulk bags. The processed beans may be sold in bulk bags, or they may be removed from storage at some future time and repacked into other types of containers as needed.

Table XI shows that the total hours of operation spent on the receiving and preparation operation for Plants A, B, C, and D were 896, 568, 651, and 1,735 hours, respectively. The rate of output varied from 3,421 pounds per hour for Plant C to 5,400 for Plant D. The rate of

TABLE X

DISTRIBUTION BY TYPE OF PACK FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

Type pack	Plant A	Plant B	Plant C	Plant D	Industry
	- - - - - - - - - - - Per cent - - - - - - - - - - -				
Retail	38.55	21.79		51.80	38.03
French 24 8-oz.	(2.55)			(30.50)	
French 24 9-oz.	(19.19)			(2.30)	
Whole 24 9-oz.	(1.28)			(2.30)	
Cut 24 8-oz.	(1.73)			(.40)	
Cut 24 9-oz.	(13.80)			(16.30)	
Polyethelene bag	8.56			16.20	10.18
Cut 12 1¼-lb.	(5.31)				
Cut 12 1½-lb.	(.25)			(16.20)	
Cut 12 1-3/4-lb.	(3.00)				
Institutional	34.22	49.62	94.80	11.60	32.28
Cut 12 2-lb.					
Cut 12 2½-lb.	(16.41)		(66.40)	(2.30)	
Cut 12 3-lb.			(20.20)		
French 12 2-lb.					
French 12 2½-lb.	(15.46)		(5.20)	(8.10)	
French 12 3-lb.			(3.00)		
Whole 12 2-lb.	(2.35)			(1.20)	
Bulk	18.67	28.59	5.20	20.40	19.51
Cut 20-lb.	(.32)				
Cut 60-lb.	(18.35)			(20.40)	
Total	100.00	100,00	100.00	100.00	100.00

TABLE XI

RATE OF OUTPUT PER HOUR AND TOTAL HOURS BY JOBS FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

Plant	Receiving and preparation	Type of Pack			
		Retail	Institutional	Bulk	Polybag
	Pounds of output				
A	3,137,307	1,209,473	1,073,672	585,630	268,532
B	2,840,648	619,153	1,409,334	812,161	--
C	2,227,120	--	2,111,560	115,560	--
D	9,366,598	4,854,107	1,078,416	1,914,149	1,519,926
	Pounds of output per hour				
A	3,500	2,296	3,477	3,355	2,971
B	5,000	1,647	3,250	3,068	--
C	3,421	--	3,621	3,302	--
D	5,400	5,803	5,443	3,627	1,500
	Hours operated				
A	896	527	309	175	90
B	568	376	434	265	--
C	651	--	583	35	--
D	1,735	836	198	528	1,013

output per hour for the various packaging operations varied considerably within each plant and among the plants. The rate of output per hour for the institutional packaging operation is higher than the rate of output for the retail and polybagging operations. Packaging beans in the bulk is performed at a rate of output per hour which is close to the rate of output for the institutional operation. Casing of the retail and institutional cartons varied from 6,000 pounds per hour for Plant A to 10,000 pounds per hour for Plant B, as is shown in Table XII. The operations of receiving and preparation were performed simultaneously, as were those of packaging and casing.

The total crew requirements for plants processing snap beans for freezing in Tennessee varied from 63 for Plant C to 158 for Plant A. The requirements differ in the most part because of the degree of mechanization of the packaging line, particularly on the cut retail and cut institutional lines. Although all of the packaging operations could be carried on at the same time in most of the plants, they usually were not; as a result, none of the plants necessarily had a crew of the size indicated in Table XIII. Women comprised more than 50 per cent of the total crew requirements for all plants. They are employed mostly on the inspection belts and packaging lines.

Table XIV shows the building requirements for the existing plants. The smallest plant had 15,875 square feet and the largest had 37,892 square feet. About 75 per cent of the total floor space required for all plants was occupied by the processing operations. The other

TABLE XII

NUMBER OF WORKERS, RATE OF OUTPUT PER HOUR, AND OUTPUT PER MAN-HOUR IN PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

Job	Plant A			Plant B		
	Number of workers	Output per hour	Output per man hour	Number of workers	Output per hour	Output per man hour
		Lbs.	Lbs./hr.		Lbs.	Lbs./hr.
Receiving and preparation	35	3,500	100	35	5,000	143
Packaging						
Retail French slice	23	2,296	100	16	1,647	103
Institutional French slice	18	3,477	193	17	3,250	190
Retail cut	22	2,296	104	8	1,647	206
Institutional cut	16	3,477	217	17	3,250	190
Bulk	10	3,355	336	4	3,068	767
Polybag	17	2,971	175	17	2,500	147
Casing	12	6,000	500	13	10,000	769

TABLE XII (continued)

Job	Plant C			Plant D		
	Number of workers	Output per hour	Output per man hour	Number of workers	Output per hour	Output per man hour
		Lbs.	Lbs./hr.		Lbs.	Lbs./hr.
Receiving and preparation	18	3,421	190	41	5,400	132
Packaging						
Retail French slice				20	5,803	290
Institutional French slice	16	3,000	188	27	5,443	202
Retail cut				10	5,803	580
Institutional cut	16	3,643	228	10	5,443	544
Bulk	6	3,302	550	7	3,627	518
Polybag				6	1,500	250
Casing	4	1,500	375	10	8,000	800

TABLE XIII

CREW REQUIREMENTS FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

Job description	Plant A			Plant B			Plant C			Plant D		
	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total
Receiving and preparation[a]	11	24	35	9	26	35	5	13	18	16	25	41
Packaging												
Retail (French)	6	17	23	6	10	16	--	--	--	6	14	20
Retail (cut)	6	16	22	5	3	8	--	--	--	4	6	10
Institutional (French)	5	13	18	6	12	18	5	11	16	7	20	27
Institutional (cut)	4	12	16	5	12	17	5	11	16	4	6	10
Bulk	10	--	10	4	--	4	6	--	6	7	--	7
Polybag	6	11	17	3	14	17	--	--	--	6	--	6
Case	7	5	12	6	7	13	4	--	4	10	--	10
Clean-up	1	--	1	1	--	1	1	--	1	6	--	6
USDA Inspector	1	--	1	1	--	1	1	--	1	1	--	1
Mechanics	2	--	2	2	--	2	1	--	1	4	--	4
Foreman	1	--	1	2	--	2	--	--	--	1	--	1
Total	60	98	158	50	84	134	28	35	63	72	71	143

[a]Includes all operations up to the packaging stage.

components and their requirements varied from plant to plant, but their areas were largely proportional to plant output.

The total fixed investment for buildings and equipment is shown in Table XIV. The total fixed investment ranged from $218,893 for the smallest plant to $578,304 for the largest. The processing equipment in the plants was a major part of the total fixed investment. The investment in processing equipment ranged from a low of $114,557 for the smallest plant to $341,866 for the largest. The investment in buildings ranged from $95,250 for the smallest plant to $227,352 for the largest. Investment in shop equipment, laboratory equipment, and office equipment was only a small portion of the total fixed investment.

I. VARIABLE COST

Variable factors are those whose usage changes as output changes. From this statement, it can be concluded that total variable costs are those that increase as output increases and decrease as output decreases. This definition is considered in the total concept and not on a per-unit basis. According to the definition that has been set forth, the miscellaneous general expense as it is presented in this analysis is not a variable cost. Although it was standardized at $11,425 for all plants in both analyses, it would vary under actual conditions as plant size varied. Rather than arbitrarily being set as a budgeted miscellaneous general expense statement, it was standardized at a constant total cost and still included as a variable cost.

TABLE XIV

BUILDING REQUIREMENTS AND INVESTMENTS IN BUILDING AND EQUIPMENT FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

Item	Plant A	Plant B	Plant C	Plant D
			Square feet	
Receiving office	180	225	--	50
Administrative office	1,800	1,500	650	1,600
Processing	14,500	22,000	10,000	29,908
Boiler	690	300	400	1,134
Shop	200	200	200	400
Lavatories and rest rooms	300	500	400	400
Storage (dry)	2,400	4,500	4,000	4,000
Laboratory	225	150	225	400
Total	20,295	29,375	15,875	37,892
			Dollars	
Building	121,770	176,250	95,250	227,352
Plant equipment	257,007	284,939	114,557	341,866
Shop equipment	2,507	2,507	2,507	2,507
Laboratory	1,850	1,850	1,850	1,850
Office equipment	4,729	4,729	4,729	4,729
Total fixed investment	387,863	470,275	218,893	578,304

The variable factors included in this analysis were processing labor, containers, freezing and storage, in-plant transportation, electricity, water, gas, brokerage, and miscellaneous general expense. Costs for three of the variable factors--freezing and storage, in-plant transportation and brokerage--were standardized at .350, .100, and .700 cents per pound, respectively.

Processing labor cost varied from a high of 2.813 cents per pound for Plant A to a low of 1.946 cents per pound for Plant C (Table XV). The factors affecting the processing labor cost per pound were output per hour and the number of workers required. In reference to Table XII, page 53, the output per man-hour was lower on most jobs for Plant A and was higher on most jobs for Plant C. If a relatively large quantity of retail beans are packed, and if other types of containers involve little or no mechanical operations, it is reasonable to expect higher processing labor costs per pound.

Container costs, as shown in Table XV, range from a low of 1.210 cents per pound for Plant C to a high of 2.283 cents per pound for Plant D. Plant C packaged only institutional cartons and bulk, whereas Plant D packaged all types of containers with the retail pack composing 51.8 per cent of the total pack as presented in Table X, page 50.

Electricity was the least expensive of all the utilities, as evidenced in Table XV. The quantity of electricity was a direct result of the number of horsepower used in the plant. Electricity cost per

TABLE XV

VARIABLE COSTS FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING PER POUND, TENNESSEE, 1963

Item	Plant A	Plant B	Plant C	Plant C	Industry	Per cent each item is of total variable cost
			-Pounds-			
Annual volume of snap beans processed (output)	3,137,307	2,840,648	2,227,120	9,366,598	17,571,673	
			-Cents-			
Processing labor	2.813	2.020	1.946	2.053	2.170	37.818
Container	1.665	1.802	1.210	2.283	1.959	34.141
Freezing and storage	.350	.350	.350	.350	.350	6.099
In-plant transportation	.100	.100	.100	.100	.100	1.743
Utilities						
Electricity	.025	.029	.018	.014	.019	.331
Water	.167	.182	.225	.071	.126	2.196
Gas	.065	.092	.055	.041	.055	.959
Brokerage	.700	.700	.700	.700	.700	12.199
Miscellaneous general expense	.364	.402	.512	.121	.259	4.514
Total variable costs	6.249	5.677	5.116	5.733	5.738	100.0

pound was lowest for Plant D, which operated over the longest season and processed the greatest quantity of green beans. Water and gas cost reacted similarly by decreasing on the cost per pound as output increased. Costs of the utilities per pound decreased as the season was lengthened and as the total pounds processed increased. The principal reason for this decrease in cost of utilities was the demand charge, which is based on the greatest requirement per hour for electricity and according to the greatest requirement per day for gas and water. This demand charge must be paid whether the utilities are used or not.

The processing labor and container costs are 37.818 and 34.141 per cent respectively of the total variable cost. Brokerage is 12.199 per cent of the total variable cost, with freezing and storage 6.099 per cent. Miscellaneous general expense, water, in-plant transportation, gas, and electricity account for the remaining 9.743 per cent of variable costs in the order named. It is unusual for water costs for any processed product to be higher than electricity costs, but the plants processing snap beans use a large quantity of water per day. One of the owners of snap bean processing plants in Tennessee found it is his advantage to install his own well.

II. FIXED COST

Fixed factors are those whose employment does not vary as output changes. As output increases, the total fixed cost remains constant.

TABLE XVI

FIXED COSTS FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING PER POUND, TENNESSEE, 1963

Plant	Annual volume of snap beans processed (output)	Plant equipment	Building	Shop equipment	Laboratory equipment	Office equipment	Administrative expense	Total fixed cost
	- - Pound - -	- - - - - - - - - - - -	- - - - -	- - - - - Cents	- - - - -	- - - - -	- - - - -	- - - - -
A	3,137,307	1.351	.358	.013	.009	.024	1.029	2.784
B	2,840,648	1.655	.572	.014	.010	.027	1.137	3.415
C	2,227,120	.848	.394	.018	.013	.035	1.010	2.318
D	9,366,598	.602	.222	.004	.003	.008	.451	1.290
Total	17,571,673	.937	.325	.009	.006	.017	.736	2.020
Percent each item is of total fixed costs		46.158	16.010	.443	.296	.837	36.256	100.00

As output increases, the average fixed cost or the fixed cost per unit of output decreases.

The fixed factors included in this analysis are plant equipment, buildings, shop equipment, laboratory equipment, office equipment, and administrative expense. The last includes only the salaries of the administrative personnel. When the fixed costs are compared for all plants, it is found that all components of fixed cost on a per-pound basis are cheaper for Plant D. Plant D had the lowest fixed cost with 1.290 cents per pound, while Plant B had the highest with 3.415 cents per pound.

Plant equipment cost for all plants was 46.158 per cent of the total fixed cost. The administrative expense was 36.256 per cent of the total cost, followed by building cost at 16.010 per cent. Office equipment, shop equipment, and laboratory equipment accounted for the remaining 1.576 per cent (Table XVI).

III. TOTAL COST

Total cost is the sum of the variable and fixed costs. Total cost varied from a low of 7.023 cents per pound for Plant D to a high of 9.092 cents per pound for Plant B (Table XVII).

Although Plant D had a higher variable cost per pound than Plants B and C, it had a much lower fixed cost per pound. Plants C and D are in a category by themselves with respect to costs; also, Plants A and B are in a separate category with respect to costs. Plants A and

TABLE XVII

TOTAL COSTS FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING PER POUND, TENNESSEE, 1963

Plant	Annual volume of snap beans processed (output)	Total variable cost	Total fixed cost	Total cost
	- - - Pounds - - -	- - - - - - - - - Cents - - - - - - -		
A	3,137,307	6.249	2.784	9.033
B	2,840,648	5.677	3.415	9,092
C	2,227,120	5.116	2.318	7.434
D	9,366,598	5.733	1.290	7.023
Total	17,571,673	5,738	2.030	7.768
Percent each is of total cost		73.867	26.133	100.00

B were similar in many respects as far as size and operation was concerned, and there was only .059 cents per pound difference in processing cost. Plant D, the largest plant, processed the largest volume of green beans. It realized benefits in the form of the lowest fixed cost per pound and the lowest total cost per pound.

The components of total cost, variable and fixed, were 73.867 and 26.133 per cent respectively of total cost (Table XVII).

CHAPTER IV

COSTS AND EFFICIENCY IN MODEL PLANTS

The model plants for this analysis were set up by using the results of the study in 4 existing plants, the equipment layout diagrams of processing machinery manufacturers, and the writer's judgment. In making changes from the existing plants to the model plants it was intended to improve efficiency and lower the processing costs. The changes made were influenced by the existing plants' operations and procedures.

I. PACK OUT

One of the factors affecting the total cost of processing, including raw product cost, is the recovery or pack out percentage. It affects the total cost for both the model plants and the existing plants in the same manner.

As discussed in Chapter III, the recovery percentage for the existing plants varied from 70 to 80 per cent, depending upon a number of factors. The recovery percentage for the model plants was standardized at 75 per cent.

The cost of snap beans to the processor in Tennessee is usually about $1.80 per bushel. Since each bushel of snap beans weighs 30 pounds, the cost per pound of snap beans is usually about 6 cents.

Information given in Table XVIII is based upon the cost of snap beans at 6 cents per pound. The pack out cost per pound of snap beans varied from a low of 6 cents per pound with 100 per cent recovery to 12 cents per pound with a 50 per cent recovery. If the recovery percentage drops to 70 per cent from 80 per cent, the total cost per pound of processing, including raw product cost, is increased one cent. Any time the pack out rate varies for any reason, the total cost per pound will be effected.

II. MODEL PLANT DESIGN AND PROCESSING PROCEDURE

Figure 12 shows the equipment layout of a model plant processing snap beans for freezing with an input capacity of 8,000 pounds per hour. Each of the ten model plants had individual characteristics but all of the plants were organized similarly to the one shown in Figure 12. The diagram as shown is one of simple design to allow a continuous flow of beans from the truck through the plant.

Figure 13 shows the diagram for the receiving and preparation operations in the model plants. The snap beans are graded before they are unloaded. The grading procedure should be thorough and fair to all concerned. If the beans contain a high percentage of trash or if they are diseased, an allowance could be made to protect the processor from bearing the cost of a lower percentage pack out. After the beans are graded at the plant, they are unloaded, and then the preparation operations start. A machine installed in the line for the receiving and

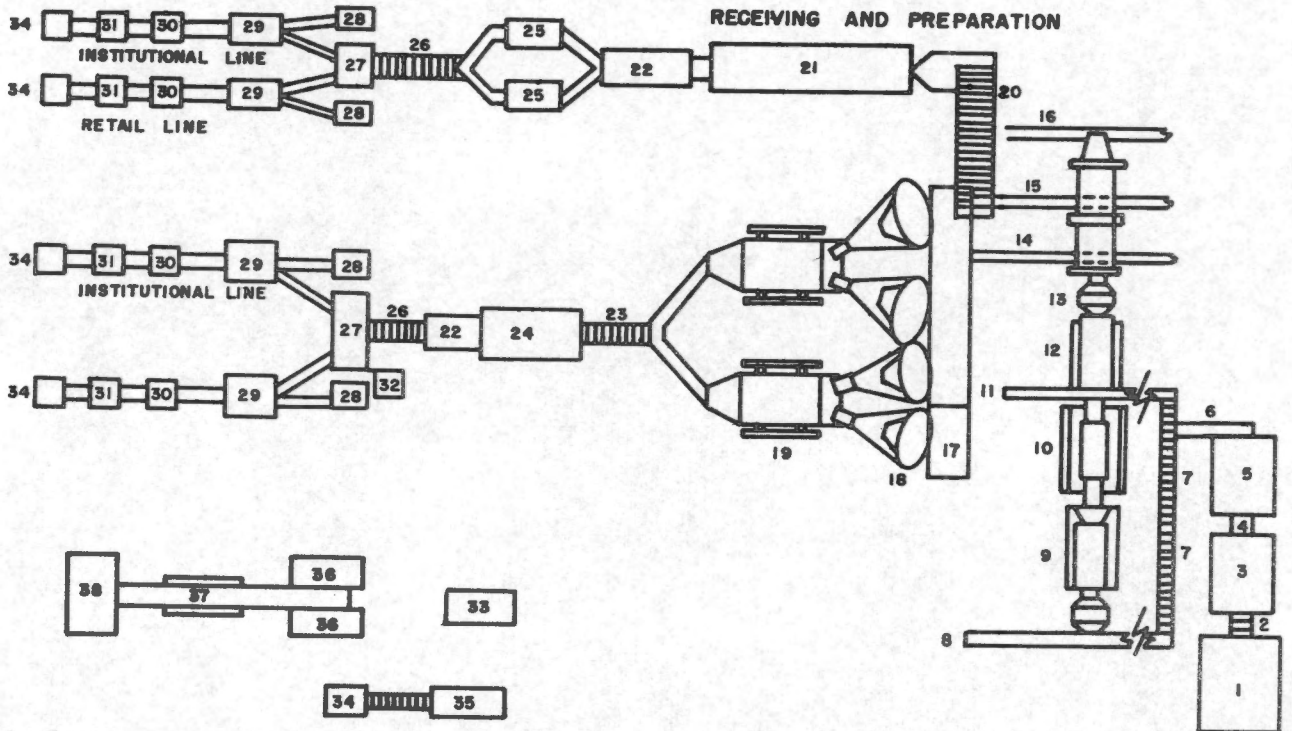
TABLE XVIII

COST PER POUND OF RAW PRODUCT ON BASIS OF PACK OUT, TENNESSEE, 1965

Input	Output (Lb.)	Recovery (Per cent)	Raw product cost[a] (Cents)	Pack out cost per pound (Cents)
100	100	100	6.000	6.0000
100	90	90	6.000	6.6666
100	80	80	6.000	7.5000
100	75	75[b]	6.000	8.0000
100	70	70	6.000	8.5714
100	60	60	6.000	10.0000
100	50	50	6.000	12.0000

[a]Raw product cost for purposes of illustration is standardized at $1.80 per bushel (30 pound) or $.06 per pound.

[b]A pack out rate of 75 per cent was used in the model plant analysis.



Legend:

1. Dump unloader
2. Flight conveyor
3. Cluster breaker
4. Blower (trash remover) and conveyor
5. Washer-destoner
6. Cross conveyor
7. Flight conveyor
8. Oscillating conveyor
9. Snipper
10. Unsnipped separator
11. Cross collection conveyor
12. Inspection belt
13. Double bar grader
14. Cross collection conveyor (1,2,3's)
15. Cross collection conveyor (4,5's)
16. Cross collection conveyor (6's)
17. Oscillating conveyor
18. Cutters
19. Shaker separator (nubbin grader)
20. Flight conveyor
21. Whole bean blancher
22. Separator (cooling assembly)
23. Flight conveyor
24. Cut bean blancher (center tube)
25. Slicer (French)
26. Flight conveyor
27. Swivel bin
28. Carton former
29. Carton filler
30. Carton
31. Wrapper
32. Collection stand (cuts, IQF)
33. Bulk fill assembly
34. Tray off station
35. Mechanical polybag filler and conveyor
36. Casing table
37. Mechanical case closer and conveyor
38. Loading platform.

Figure 12. Equipment layout for a model plant processing snap beans for freezing.

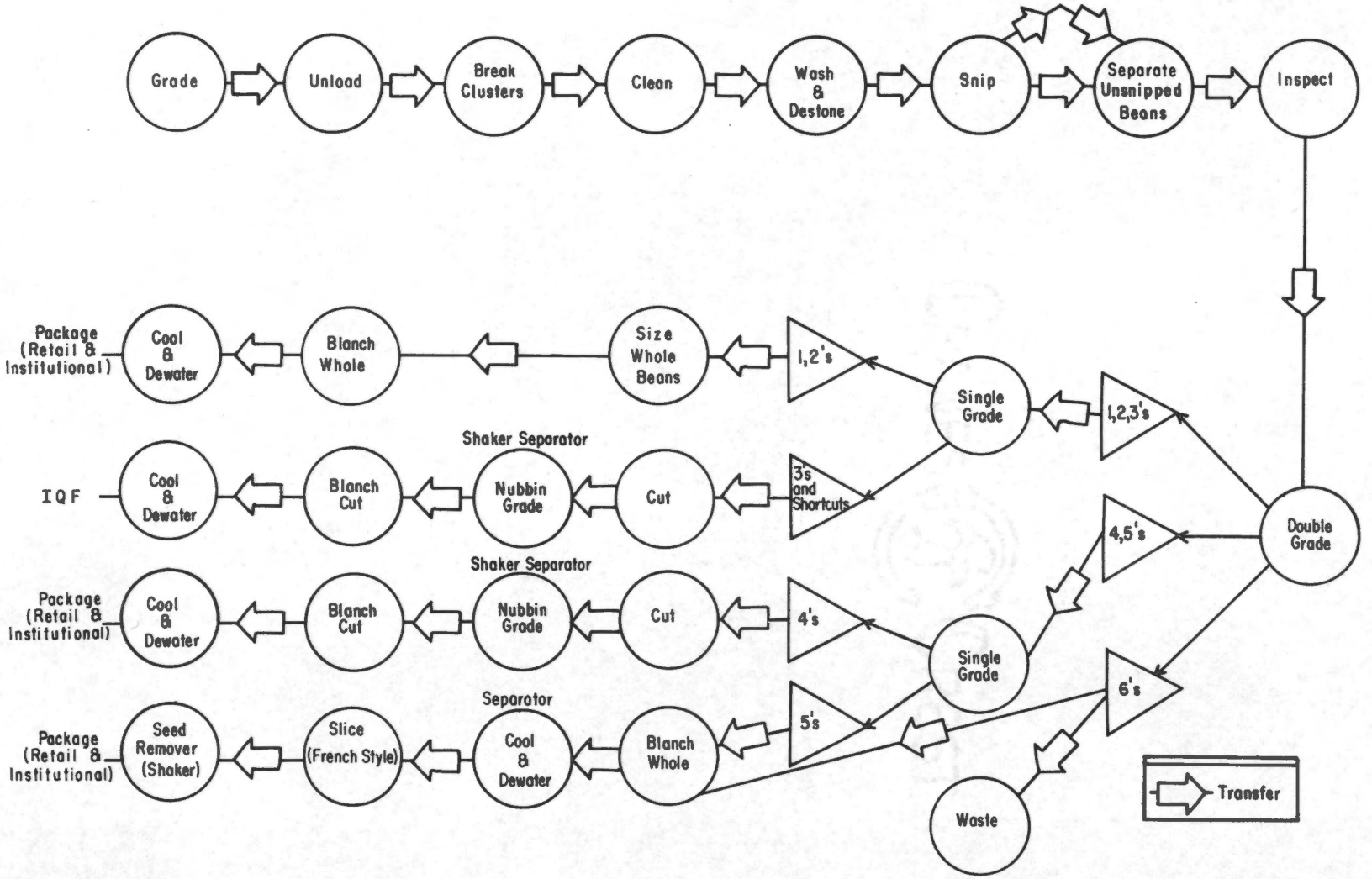


Figure 13. Receiving and preparation operations in a model plant processing snap beans for freezing.

preparation operations in model plants, but not found in existing plants, is the unsnipped separator. This is a simple machine which removes unsnipped beans that have passed through the snippers. A conveyor returns these unsnipped beans to the snippers. The workers on the inspection belts can then devote their entire attention to picking out diseased and damaged beans. By using the unsnipped separator it is possible to reduce the number of workers on each inspection belt to two, and if the beans are not diseased and have a low content of foreign matter, one worker per inspection belt may be sufficient.

To facilitate packing a more desirable product, nubbin graders were included after the cutters to remove the nubs or extremely short-cut beans. Single graders are not needed in the snap bean processing plants unless the processors are packaging whole beans or packing the cut beans by individual sieve sizes.

Figure 14 shows the packaging operations in the model plants. Cut beans are packed mechanically in both the institutional and retail cartons. The whole and sliced beans are packed by hand. Mechanical fillers are available for these products but the managers of the existing plants have not been able to fill containers satisfactorily with whole and sliced beans. Mechanical weighing machines are used in the packaging lines to facilitate the adjustment of carton weights and check-weighing.

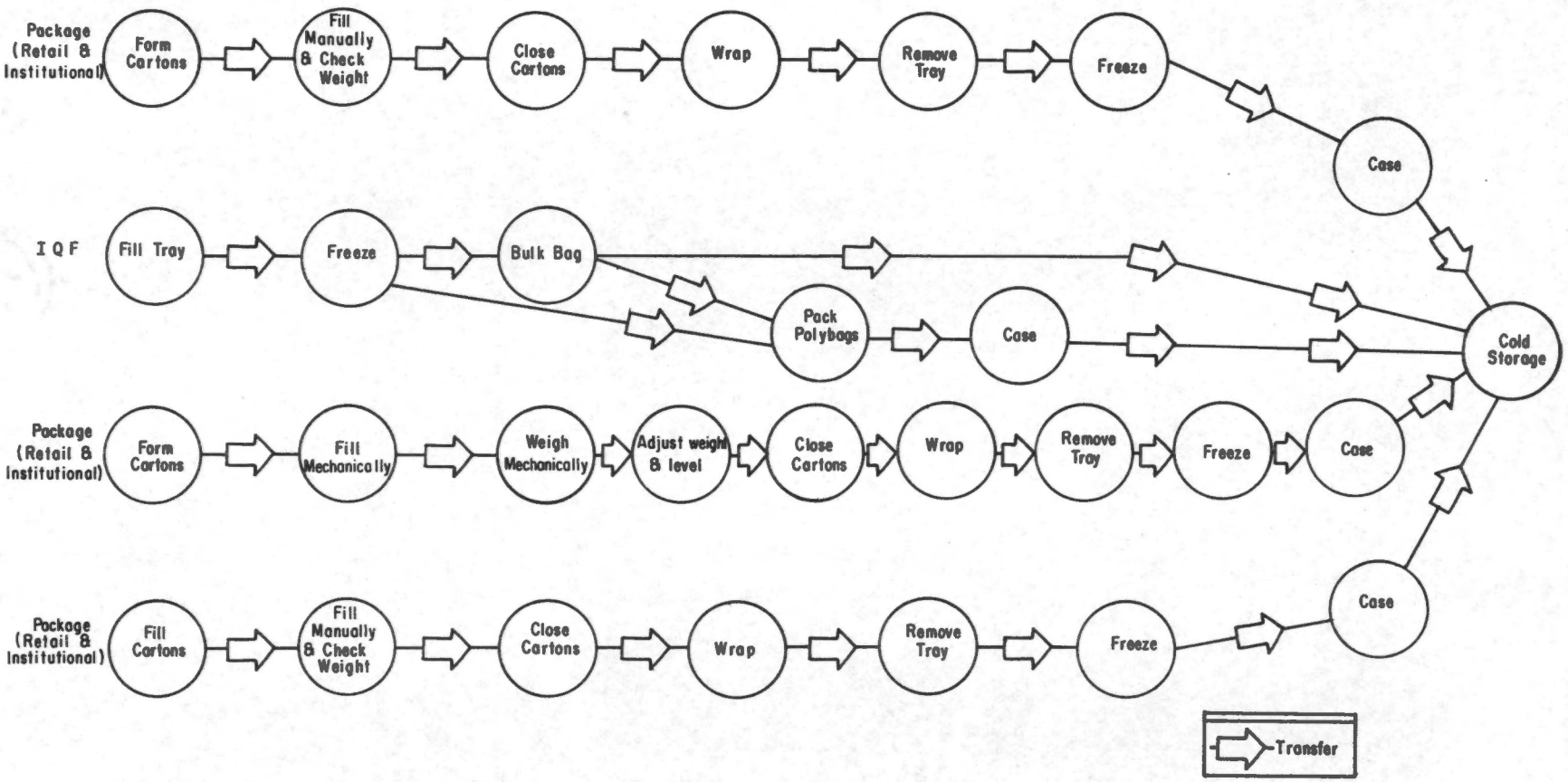


Figure 14. Packaging operations in a model plant processing snap beans for freezing.

III. PRODUCT MIX FOR MODEL PLANTS

The product mix for the model plants, or the percentage of the total pack allocated to type of pack, was standardized as shown in Table XIX. Although the existing plants do not package all the products in the various styles of containers, it was desirable to package all products in the various containers in the model plants to make it possible to make valid comparisons of costs between plants.

IV. INVESTMENT IN BUILDINGS AND EQUIPMENT

The building space requirements for a snap bean processing plant are shown in Table XX. The size of building required, for example, for plants I and X, were estimated at 9,250 and 29,600 square feet, respectively.

Table XXI shows the investment in the buildings for Plants I and X were $55,000 and $179,600, respectively. The investment in equipment, for example, for Plants I and X were $147,535 and $559,309, respectively. The equipment needed in a snap bean processing plant includes receiving, unloading, laboratory shop and office and equipment.

V. WORKER REQUIREMENTS AND RATES OF OUTPUT

Crew requirements for each model plant were estimated according to the rate of input for individual plants. The crew requirements for the packaging and casing operations were standardized for all of the

TABLE XIX

DISTRIBUTION BY TYPE OF PACK FOR MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1965

Type of pack	Per cent of total pack	
Retail[a]		
French Slice	25	
Cut	15	
Whole	2	
Subtotal		42
Institutional[b]		
French Slice	11	
Cut	15	
Whole	2	
Subtotal		28
Polybag[c]		10
Bulk[d]		20
TOTAL		100

[a] 9-ounce carton

[b] 2 1/2-pound carton

[c] 20-ounce polybag

[d] 60-pound bag.

TABLE XX

BUILDING SPACE REQUIREMENTS FOR MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1965

Plant	Receiving office	Admin. office	Processing area[a]	Boiler room	Shop	Rest room	Lab.	Total
	Square feet							
I	200	650	7,000	400	400	300	300	9,250
II	200	750	9,000	800	400	300	300	11,750
III	200	850	11,000	800	400	400	300	13,950
IV	200	950	13,000	800	400	400	300	16,050
V	200	1,000	15,000	800	400	400	300	18,100
VI	200	1,100	17,000	1,200	400	500	300	20,700
VII	200	1,250	19,000	1,200	400	500	300	22,850
VIII	200	1,400	21,000	1,200	400	500	300	25,200
IX	200	1,500	23,000	1,500	400	600	300	27,500
X	200	1,600	25,000	1,500	400	600	300	29,600

[a]The processing area requirements were estimated from the equation: $A=5000+1{,}005\ R$ where A = total roofed area and R = rate in 1,000 pounds input per hour. (Source: Robert H. Reed and L. L. Sammet. Multiple-Product Processing of California Frozen Vegetables, Giannini Research Report No. 264 (Berkley: University of California, 1963), p. 37.)

TABLE XXI

INVESTMENT IN BUILDINGS AND EQUIPMENT FOR MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1965

Plant	Building	Equipment				
		Processing	Laboratory	Office	Shop	Total
	Dollars					
I	55,500	138,449	1,850	4,729	2,507	203,035
II	70,500	183,059	1,850	4,729	2,507	262,645
III	83,700	247,886	1,850	4,729	2,507	340,672
IV	96,300	298,555	1,850	4,729	2,507	403,941
V	108,600	323,754	1,850	4,729	2,507	441,440
VI	124,200	392,531	1,850	4,729	2,507	525,817
VII	137,100	415,191	1,850	4,729	2,507	561,377
VIII	151,200	453,969	1,850	6,108[a]	2,507	615,634
IX	165,000	525,989	1,850	6,108[a]	2,507	701,454
X	177,600	548,844	1,850	6,108[a]	2,507	736,909

[a]The standard office equipment is varied by adding two electric typewriters, $650; two secretarial desks, $214; adding machine, $275; and two 4-drawer filing cabinets, $240.

model plants but the number of workers in the receiving and preparation stage were varied from plant to plant.

The output per man hour for all jobs are shown in Table XXII. The output per man hour in the receiving and preparation stage increased from Plant I to Plant V but it decreased for Plant VI. The cause of this decrease was the preparation of a more diversified product brought about by the packaging of whole beans. In all packaging operations the output per hour was standardized for the analysis. The number of lines was varied to package all of the processed product. To maintain maximum economic efficiency in packaging, the packaging lines must operate at 100 per cent of their rated capacity.

VI. COST AS AFFECTED BY PLANT CAPACITY

Figure 15 illustrates how the percentage of plant capacity utilized affects both variable and fixed costs. The illustration is based upon Plant I operating 1,000 and 2,000 hours during the processing season. The different capacities examined are 50, 75, and 100 per cent.

Variable Cost

Costs of receiving, preparation, processing, containers, freezing and storage, in-plant transportation, electricity, water, gas, and brokerage increased as the volume of output was increased by varying either the length of season or plant size. The variable cost per pound decreased slightly as output was increased.

TABLE XXII

NUMBER OF WORKERS, RATE OF OUTPUT PER HOUR AND OUTPUT PER MAN-HOUR IN MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1965

Job	Plant	Number of workers	Output per hour	Output per man-hour
			Pounds	Lb./hr.
Receiving and preparation	I	10	1,500	150
	II	14	3,000	214
	III	16	4,500	281
	IV	20	6,000	300
	V	22	7,500	341
	VI	29	9,000	310
	VII	32	10,500	328
	VIII	34	12,000	353
	IX	38	13,500	355
	X	40	15,000	375
Packaging[a]				
Retail				
French slice		16	2,800	175
Cut		12	3,500	292
Whole		16	2,800	175
Institutional				
French slice		14	3,500	250
Cut		11	4,000	364
Whole		14	3,500	250
Polybag		6	2,000	333
Bulk		8	5,600	700
Casing		9	8,100	900

[a]A standard crew and rate of output is used in the packaging operations for all ten model plants.

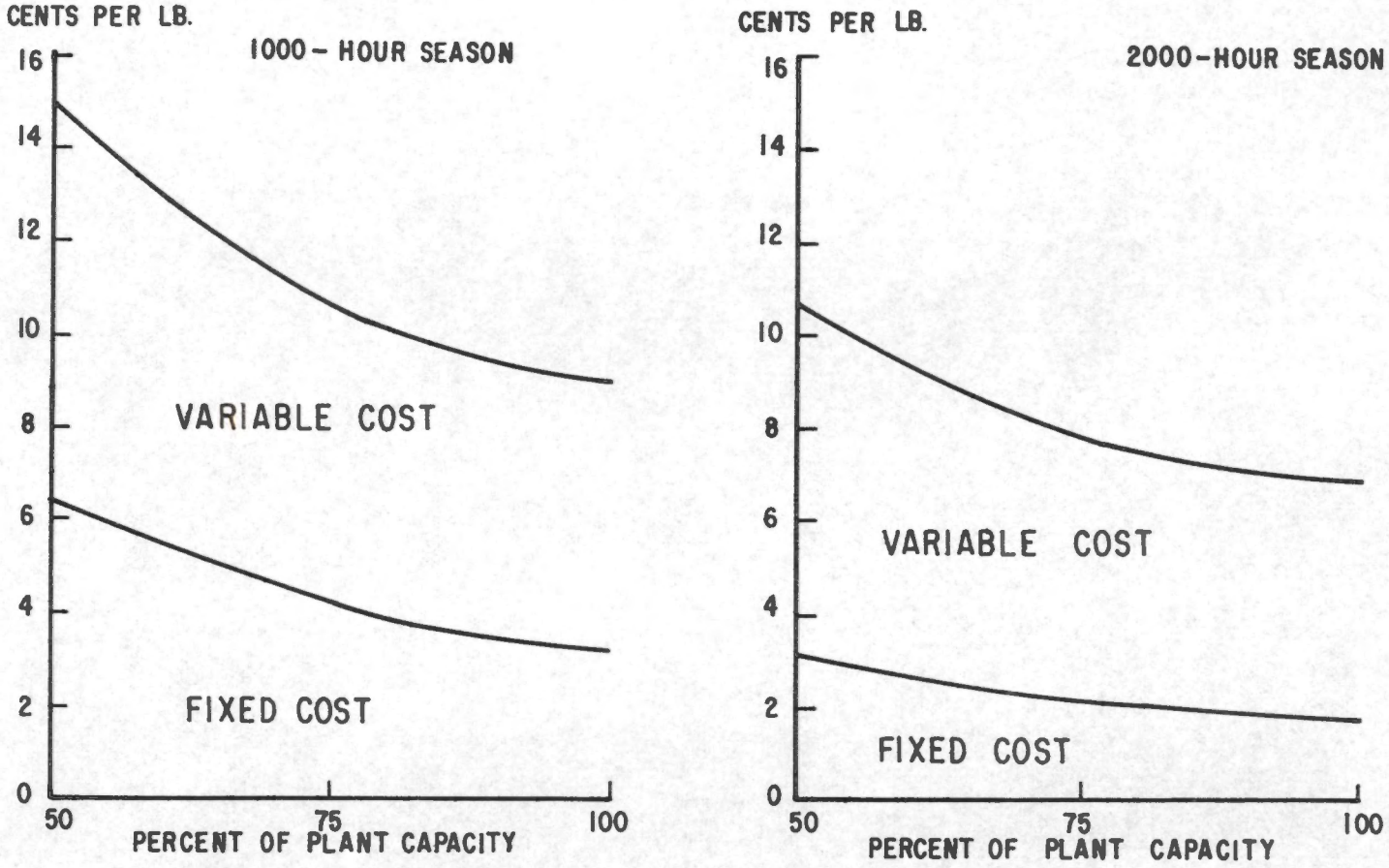


Figure 15. Relationship of use of plant capacity to average variable cost and average fixed cost for model plant I packaging snap beans in the retail (French slice and whole) containers, Tennessee, 1965.

Assumptions: Input, 2,000 pounds per hour at 100 per cent capacity; recovery 75 per cent; operating season, 1,000 and 2,000 hours.

The average variable cost per pound for Plant I, operating over a 1,000-hour season, decreases as output is increased by raising the utilized capacity from 50 to 100 per cent. The variable cost components which decrease in cost per pound are electricity, water, gas, and miscellaneous general expense, receiving, and preparation labor. The costs of electricity, water, and gas have a fixed demand charge with a much lower rate for commodity or energy charge. As the volume of output is increased, the demand charge per unit of output decreases. The miscellaneous general expense, per pound of output, decreases as output is increased. Receiving and preparation labor cost per pound of output decreases as the output per man-hour increases for the model plants. The output per man-hour increases as plant size increases in every plant except Plant VI.

Average variable cost can be decreased by expanding the length of the processing season and operating at full capacity. With Plant I, operating 1,000 hours and packaging in the retail (French slice and whole snap beans) container with a 75 per cent pack out, the variable costs at 50, 75, and 100 per cent capacity are 8.583, 7.786, and 7.409 cents per pound, respectively, or 1.174 cents per pound range as use of capacity goes from 50 to 100 per cent. For this same size plant operating 2,000 hours, the costs are 7.493, 7.061, and 6.863 cents per pound at 50, 75, and 100 per cent of capacity, respectively.

Fixed Cost

The fixed costs in this analysis include cost of plant equipment, buildings, shop equipment, laboratory equipment, office equipment, and administrative expense. The annual fixed costs are derived by using those costs related to ownership of buildings and equipment (depreciation, taxes, interest on investment, maintenance and repairs, and insurance). In addition, fixed costs include administrative expense (salaries for management, supervisors, and office personnel). Fixed costs per unit of product decline in direct proportion to increases in volume.

In Plant I, the fixed costs for operating 1,000 hours are 6.370, 4.246, and 3.185 cents per pound at 50, 75, and 100 per cent of capacity, respectively. There is a reduction of 3.185 cents per pound when the plant operation is changed from 50 to 100 per cent capacity. When the operating period is changed to 2,000 hours for Plant I, the fixed costs are 3.185, 2.123, and 1.592 cents per pound at 50, 75, and 100 per cent of capacity, respectively (Figure 15).

As plant size increases, the average fixed costs decrease (Figure 16). The average fixed costs are 3.185, 1.676, 1.321, 1.127, and 1.047 cents per pound when Plants I, III, VI, IX, and X operate over a 1,000-hour season at 100 per cent of capacity, respectively. The average fixed costs for the same plants operating over a 2,000-hour season at 100 per cent of capacity are 1.592, .838, .660, .564, and .524 cents per pound. Average fixed costs decrease 2.138 cents per pound as plant

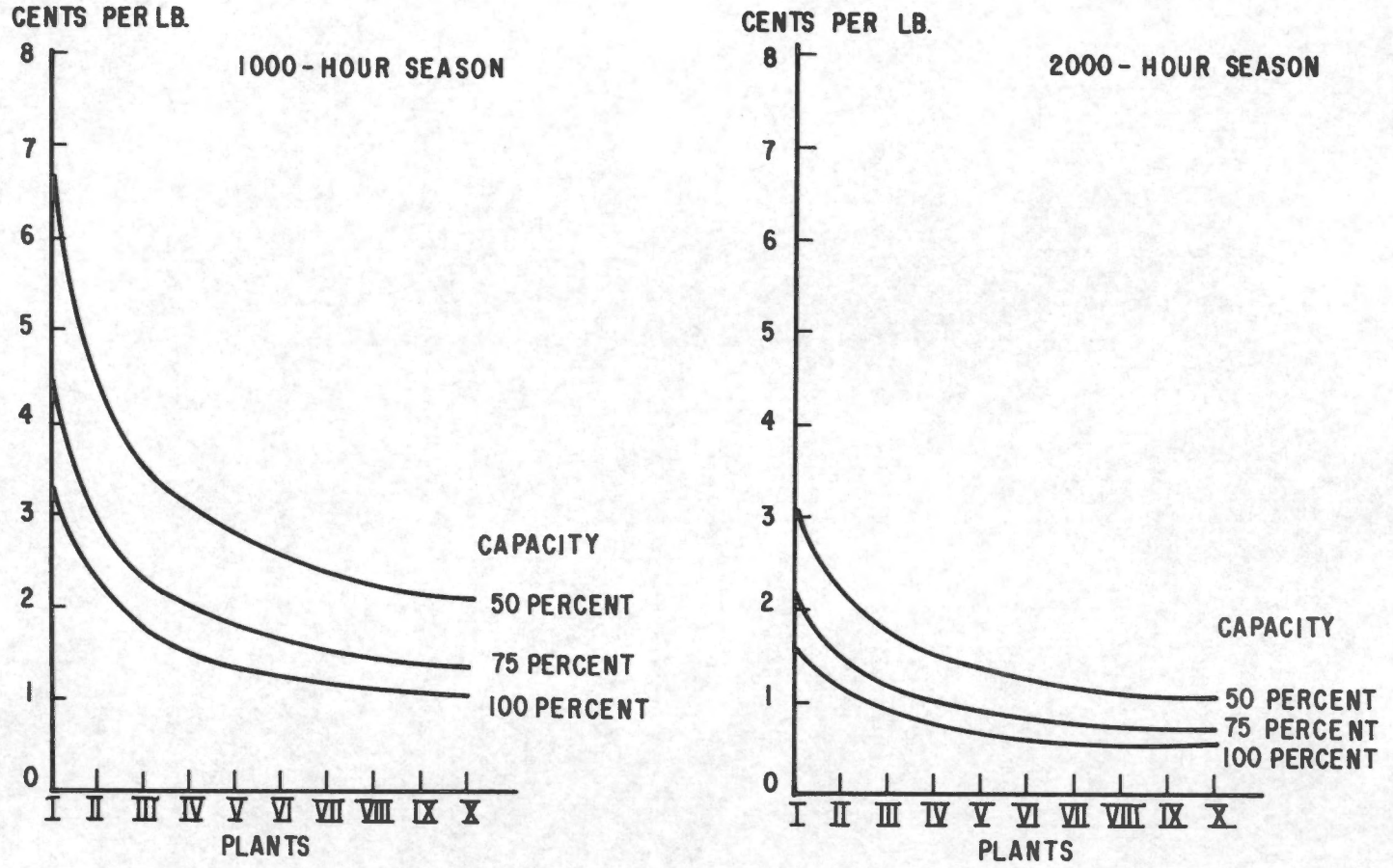


Figure 16. Relationship of average fixed costs and plant size for model plants processing snap beans for freezing at varying capacities, Tennessee, 1965.

Assumptions: Input in pounds per hour for each plant: I--2,000 pounds, II--4,000 pounds, III--6,000 pounds, IV--8,000 pounds, V--10,000 pounds, VI--12,000 pounds, VII--14,000 pounds, VIII--16,000 pounds, IX--18,000 pounds and X--20,000 pounds at 100 per cent capacity; operating season, 1,000 and 2,000 hours; recovery, 75 per cent.

size increases from 2,000 pounds input per hour (Plant I) to 20,000 pounds input per hour (Plant X).

VII. PLANT SIZE AND USE OF CAPACITY

The degree to which the level of operating capacity affects the average total cost per pound of output depends to some extent on the size of the processing plant. Figure 17 shows that the slope of the average total cost curve for Plant X, operating over a 1,000-hour season and packaging French slice and whole snap beans in the retail and institutional container, is not as great as the slope of the average total cost curve for Plant I under the same operating conditions.

The average total costs for operating at 50 and 100 per cent of capacity for Plant I over a 1,000-hour season is 14.953 and 10.594 cents, respectively, for the retail container with a cost spread of 4.359 cents per pound. When the institutional container is packed and operating at 50 and 100 per cent of capacity, the costs are 13.529 and 9.170 cents per pound, respectively, with a cost spread of 4.359 cents per pound. For Plant X, the difference is 1.208 cents per pound for both the retail and institutional containers.

As plant size increases from Plant I to X, the cost for packaging French slice and whole snap beans in the retail and institutional containers decreases from 4.359 to 1.208 cents per pound as operating capacity varies from 50 to 100 per cent. It is noted that the spreads are the same for both retail and institutional containers. When packaged

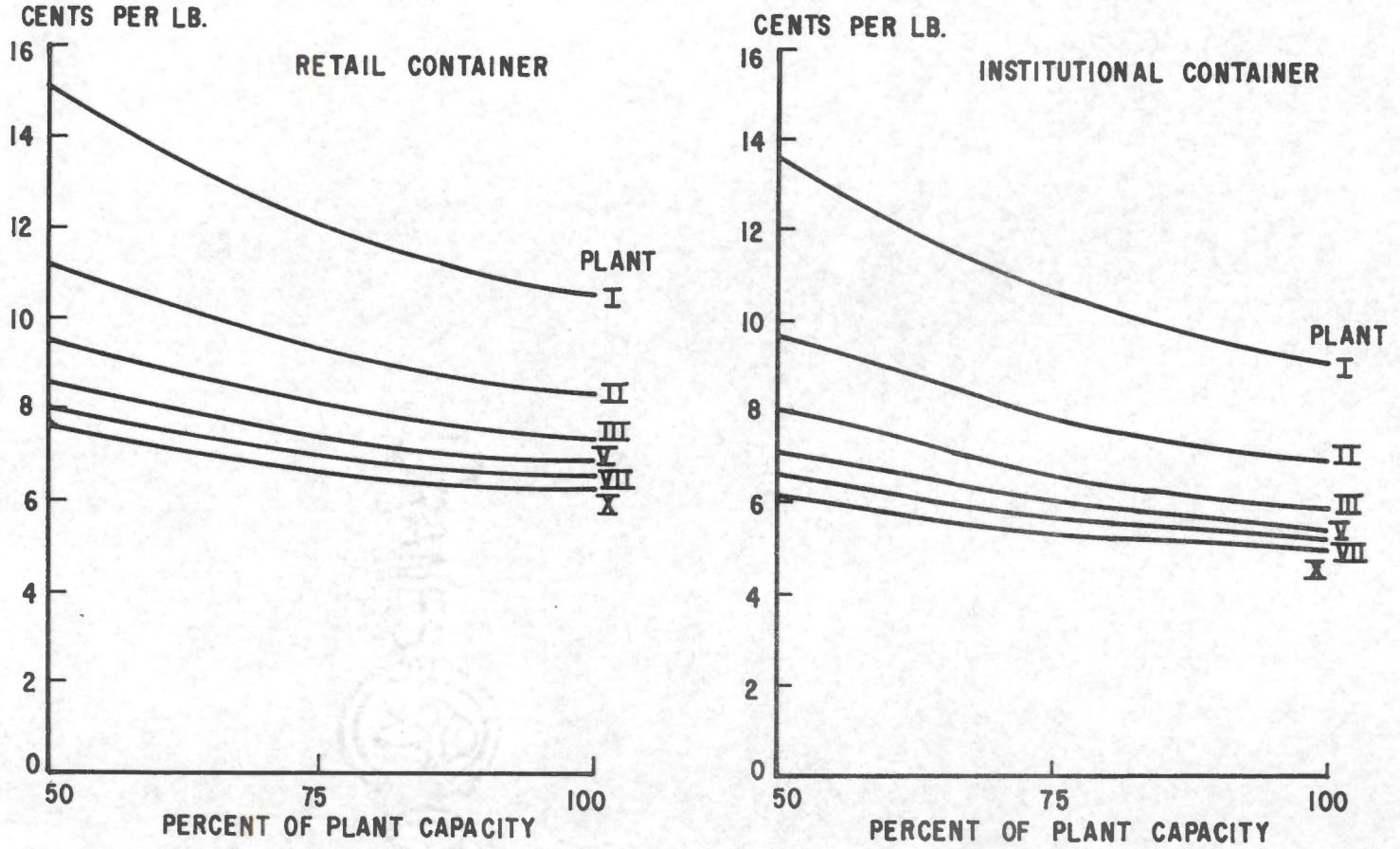


Figure 17. Relationship of plant size and use of capacity to average total costs per pound for six model plants packaging snap beans in the retail (French slice and whole) and institutional (French slice and whole) containers, Tennessee, 1965.

Assumptions: Input capacity per hour for each plant: I--2,000 pounds, II-4,000 pounds, III--6,000 pounds, V--10,000 pounds, VII--14,000 pounds and X--20,000 pounds, at 100 per cent capacity; operating season, 1,000 hours; recovery, 75 per cent.

by a single size plant, the cost spreads are the same because all costs are the same for each container, except the direct packaging labor, container, wrapping, and casing cost.

VIII. PLANT SIZE AND VOLUME

Figures 18 and 19 show the short-run average total unit costs and long-run average costs for 5 model plants. It is assumed that the plants are operating over 1,000- and 2,000-hour seasons and packing French slice and whole beans in the retail and institutional containers with a recovery of 75 and 85 per cent, respectively. There are internal economies of scale which may be dependent on appropriate adjustment of scale of plant to each successive output. Specific variable cost inputs were held constant in the analysis of the model plants. With an assumption of constant variable costs the long-run average costs would decline virtually to a constant cost curve.

Packing in the Retail and Institutional Container

With the model plants operating at full capacity with 75 per cent of recovery for a 1,000-hour season, the processing cost saving from Plant I to Plant X (2,000 to 20,000 pounds per hour input) is 4.245 cents per pound, and for a 2,000-hour season, 2.674 cents per pound. About 52 per cent of the saving--2.221 cents per pound--results as plant size increases from 2,000 to 4,000 pounds input per hour. There is only 0.093 cent per pound difference in processing cost between Plants IX and X.

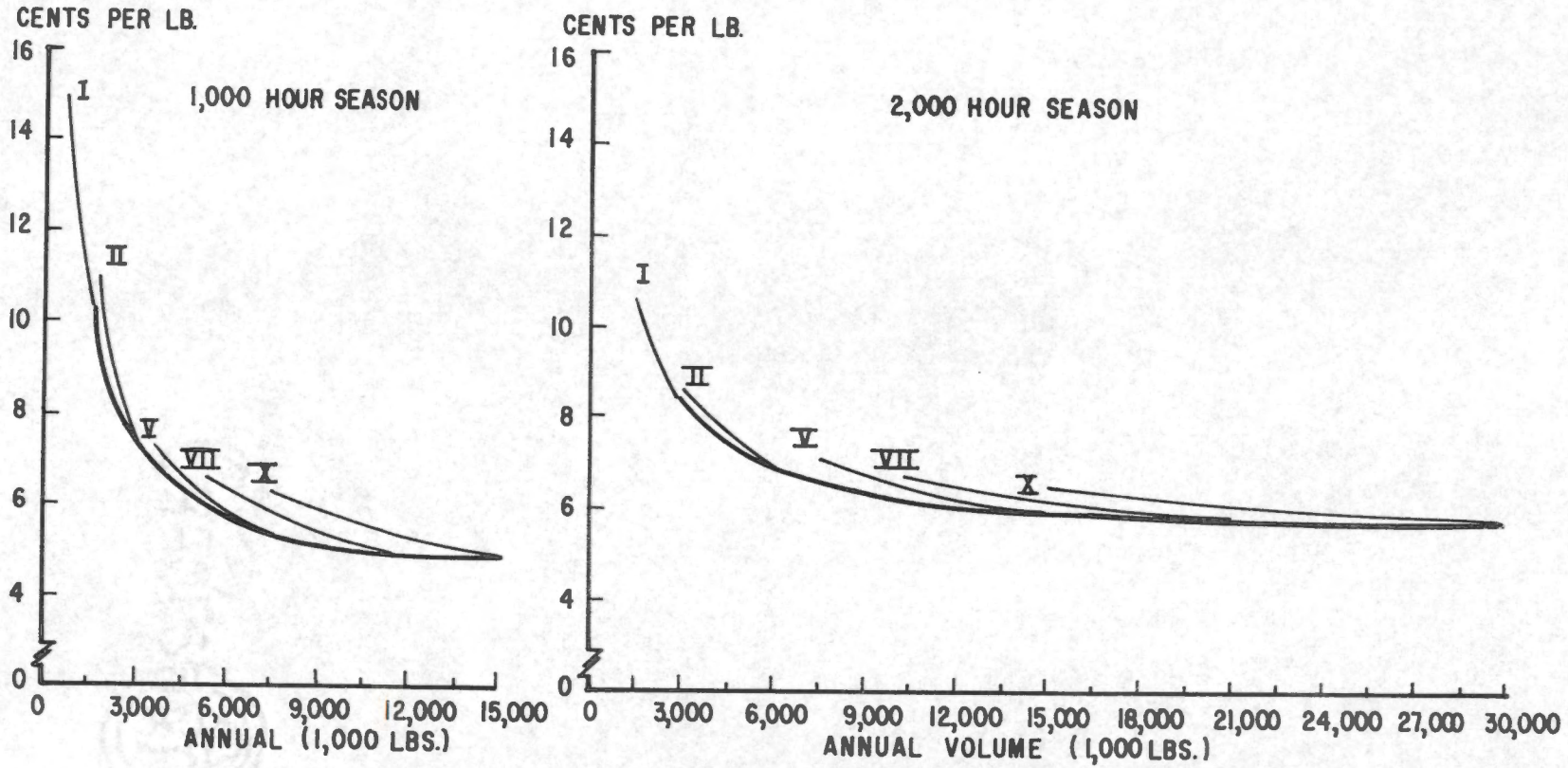


Figure 18. Relationship of plant size and volume to average total costs per pound for selected model plants packaging snap beans in the retail (French slice and whole) containers, Tennessee, 1965.

Assumptions: Input capacity per hour for each plant: I--2,000 pounds, II--4,000 pounds, V--10,000 pounds, VII--14,000 pounds and X--20,000 pounds at 100 per cent capacity; operating season, 1,000 and 2,000 hours; recovery, 75 per cent.

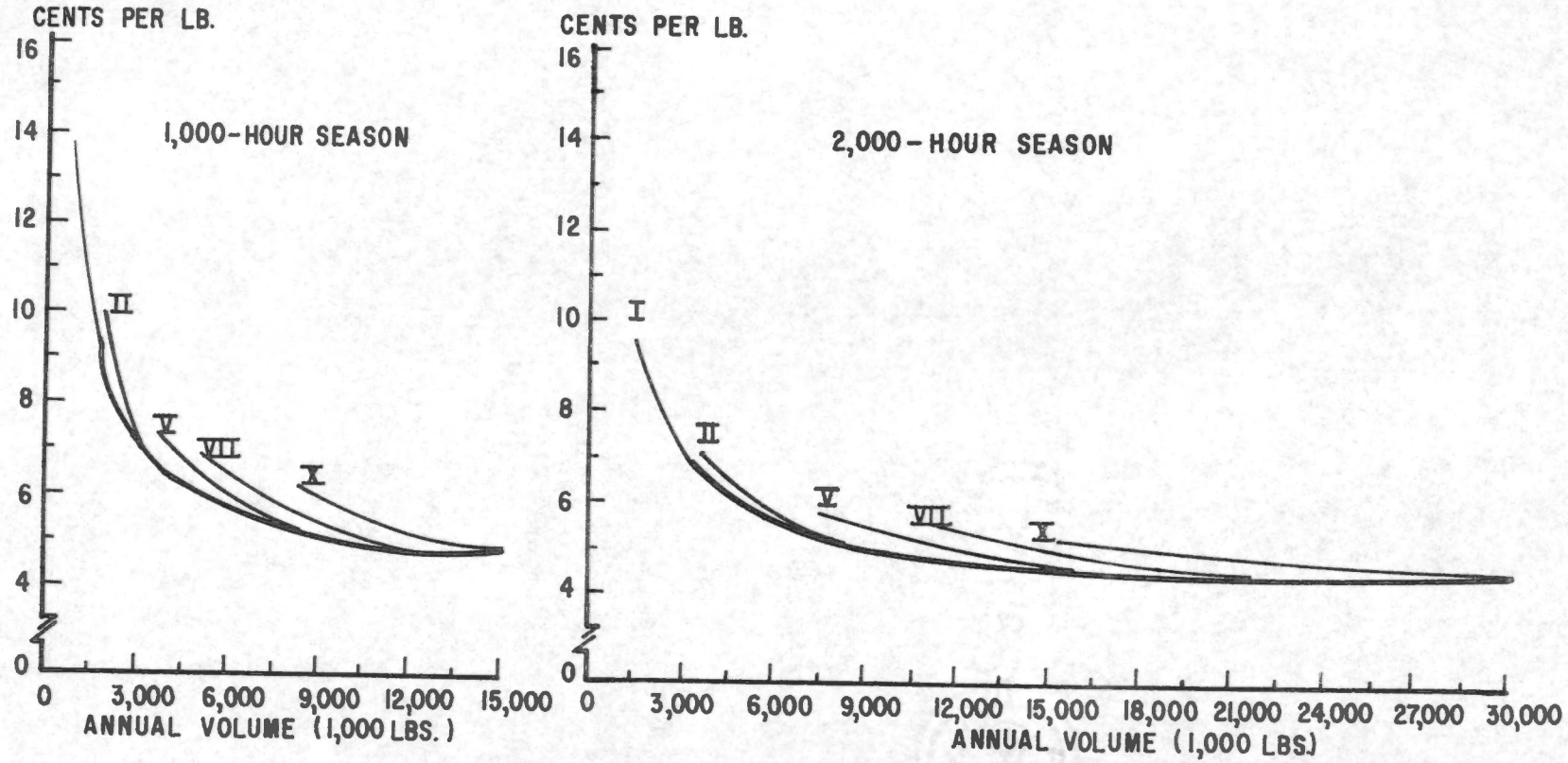


Figure 19. Relationship of plant size and volume to average total costs per pound for selected model plants packaging snap beans in the institutional (French slice and whole) containers, Tennessee, 1965.

Assumptions: Input capacity per hour for each plant: I--2,000 pounds, II--4,000 pounds, V--10,000 pounds, VII--14,000 pounds and X--20,000 pounds at 100 per cent capacity; operating season, 1,000 and 2,000 hours; recovery, 75 per cent.

IX. CONTAINERS PACKED AND PLANT SIZE

For the model plant analysis, the size of the various containers is standardized. The standardized container sizes are: retail (9-ounce) carton, institutional (2½-pound) carton, polybag (20-ounce), bulk bag (60-pound). In existing plants the container sizes vary according to the customer's specifications.

Table XXIII shows the direct cost of packing in the various size containers. The total cost for packing in polybags is 6.6 cents per pound as compared with .4 cent per pound for packing in bulk bags. Container cost per pound is highest for polybags and lowest for the bulk bags. Labor cost per pound of output is higher for French slice and whole snap beans because they are handpacked and therefore, have a higher labor requirement than cut snap beans.

Figure 20 presents the average total costs for all containers packed in the model plants. Packing in large container results in lower processing costs per pound. When Plant I operates at full capacity for a 1,000-hour season and packs polybags, retail (French slice and whole) cartons, retail (cut) cartons, institutional (French slice and whole) cartons, institutional (cut) cartons, and bulk bags, the costs are 13.955, 10.594, 10.450, 9.170, 9.004, and 7.756 cents per pound, respectively. Bulk bags can be packed 6.199 cents per pound cheaper than polybags. When Plant I operates 2,000 hours, the costs for the respective containers are: polybag 9.142 cents, retail (French slice and whole) cartons 5.781 cents, retail (cut) cartons 5.637 cents,

TABLE XXIII

DIRECT COST BY SIZE OF CONTAINER AND TYPE OF PACK FOR MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE 1965[a]

Type of pack and size of container	Cost				
	Container[b]	Wrapper[c]	Case	Labor[d]	Total
	Cents per pound				
Retail (9-ounce)					
French slice	1.2009	.9977	.4690	.5714	3.2390
Cut	1.2009	.9977	.4690	.4276	3.0952
Whole	1.2009	.9977	.4690	.5714	3.2390
Institutional (2 1/2-pound)					
French slice	.7071	.3030	.3049	.5000	1.8150
Cut	.7071	.3030	.3049	.3338	1.6488
Whole	.7071	.3030	.3049	.5000	1.8150
Polybag (20-ounce)	5.7960	--	.4288	.3750	6.5998
Bulk (60-pound)	.2227	--	--	.1786	.4013

[a]The labor cost per pound for receiving and preparation operations in each model plant is as follows: I = 1.806, II = 1.198, III = .841, IV = .842, V = .806, VI = .859, VII = .806, VIII = .785, IX = .762, and X = .728.

[b,c,d]For cost of each item see Table V, p. 21.

[e]Includes only the direct packaging labor.

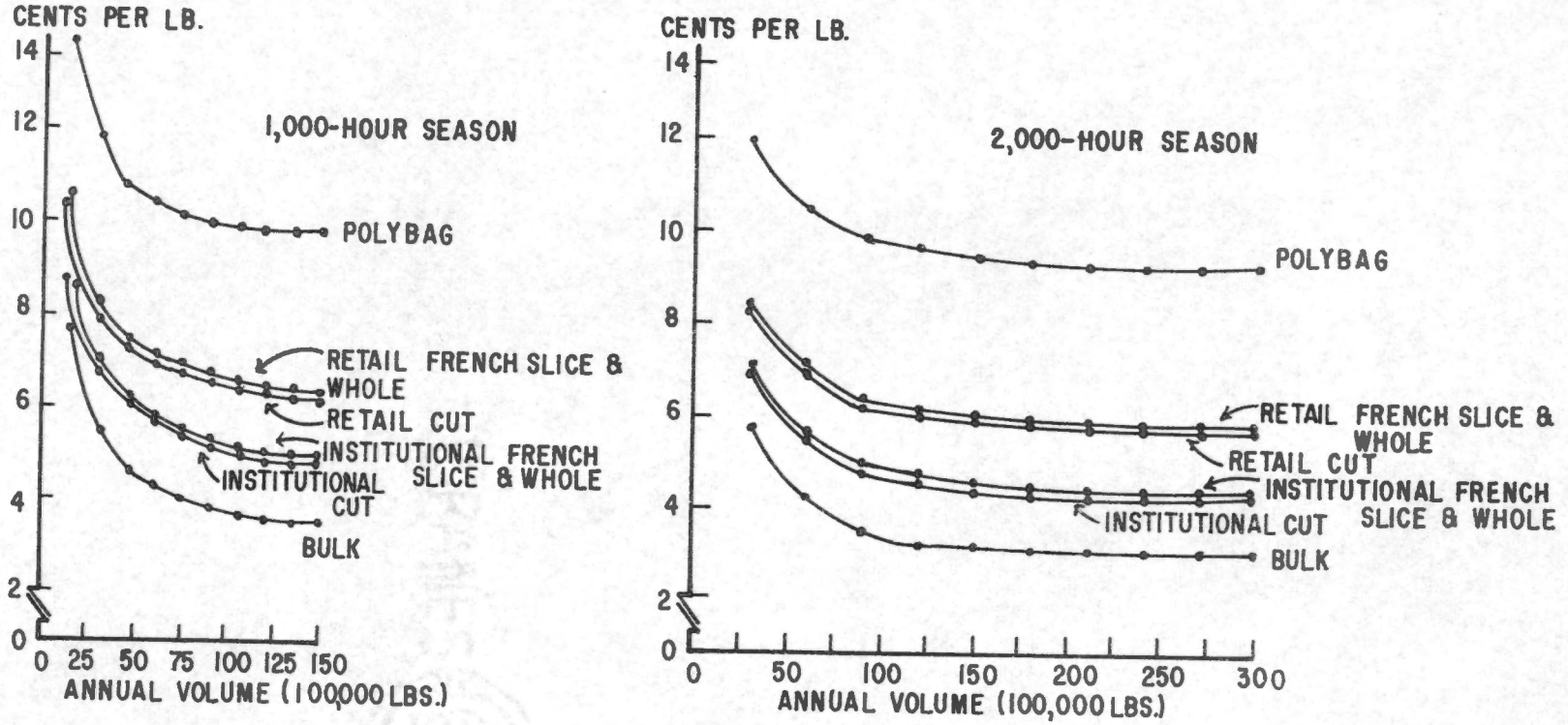


Figure 20. Relationship of containers packaged to average total costs per pound for model plants operating at 100 per cent capacity, Tennessee, 1965.

Assumptions: Input in pounds per hour for each plant: I--2,000 pounds, II--4,000 pounds, III--6,000 pounds, IV--8,000 pounds, V--10,000 pounds, VI--12,000 pounds, VII--14,000 pounds, VIII--16,000 pounds, IX--18,000 pounds and X--20,000 pounds at 100 per cent capacity; operating season, 1,000 and 2,000 hours; recovery, 75 per cent.

institutional (French slice and whole) cartons 4.357 cents, institutional (cut) cartons 4.191, and bulk bag 2.943 cents. It is observed that the costs drop sharply as the plant size is increased from 2,000 to 6,000 pounds per hour (Plants I-III), but these costs drop less sharply from Plant IV to Plant X.

X. LENGTH OF SEASON

Figure 21 illustrates the relationship of the hours of operation per season to the average total cost per pound when packing retail (French slice and whole) cartons. Average total cost per unit of output decreases sharply through the first 800 to 1,000 hours of operation. As the season is extended to 1,600 hours, the average cost decreases slightly. For Plant X operating 800 hours at 100 per cent capacity and packaging in the retail (French slice and whole) cartons, the average total cost is 6.646 cents per pound compared with 6.349 cents per pound for 1,000 hours. At 1,600, 1,800, and 2,000 hours, the average total cost per pound is 5.934, 5.849, and 5.781 cents per pound, respectively. There are greater average total cost spreads for small plants than for the larger plants. The average total cost for Plant I operating 800 and 2,000 hours at 100 per cent capacity is 11.676 and 8.455 cents per pound, respectively, with a spread of 3.221 cents per pound. For Plant X operating 800 and 2,000 hours at 100 per cent capacity, the average total cost is 6.646 and 5.781 cents per pound, respectively, with a spread of .865 cents per pound.

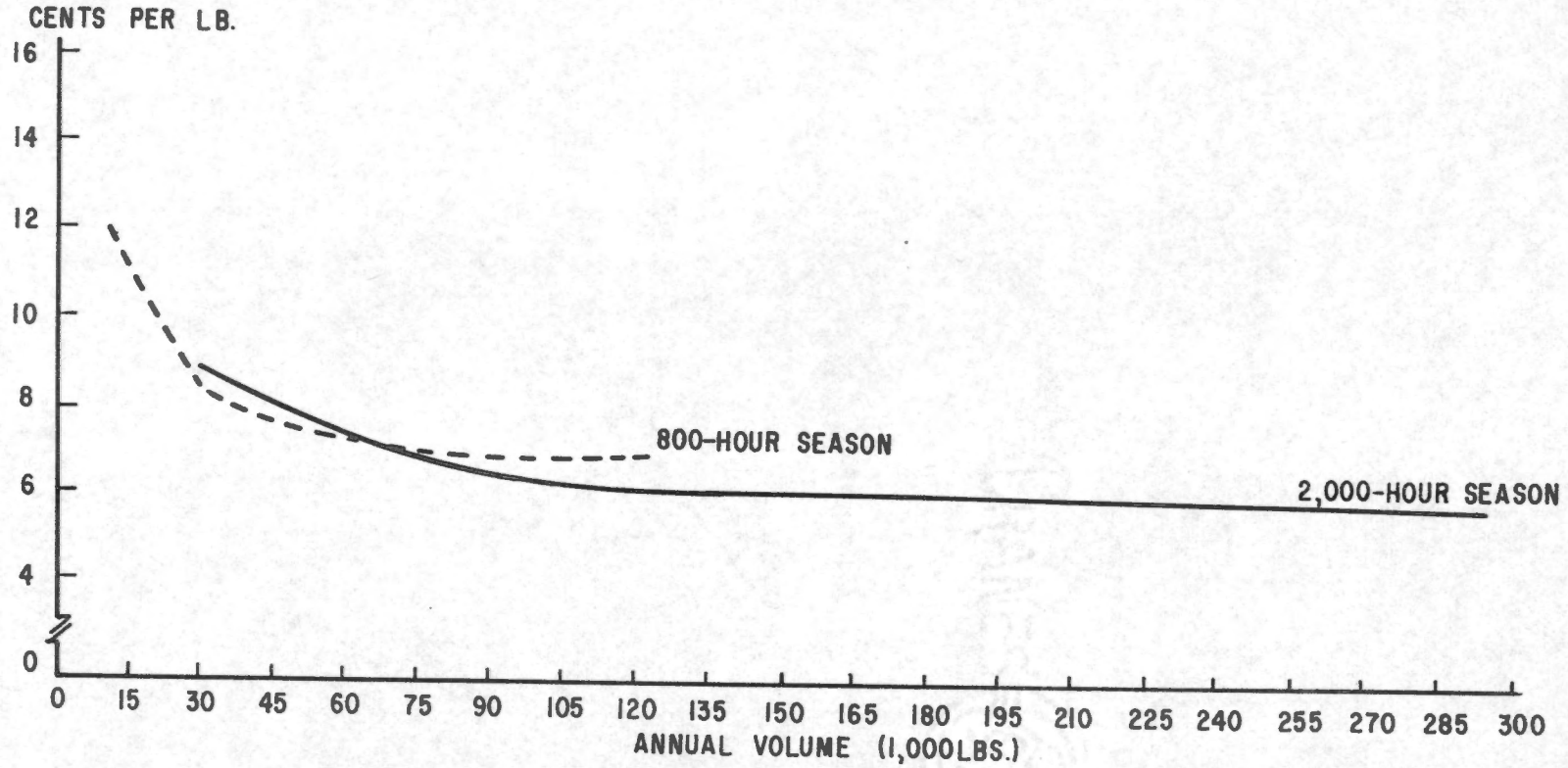


Figure 21. Relationship of length of season to average total costs per pound for model plants operating at 100 per cent capacity and packaging snap beans in the retail (French slice and whole) containers, Tennessee, 1965.

Assumptions: Input in pounds per hour for each plant: I--2,000 pounds, II--4,000 pounds, III--6,000 pounds, IV--8,000 pounds, V--10,000 pounds, VI--12,000 pounds, VII--14,000 pounds, VIII--16,000 pounds, IX--18,000 pounds and X--20,000 pounds at 100 per cent capacity; operating season in hours: 800 hours and 2,000 hours; recovery, 75 per cent.

CHAPTER V

SUMMARY AND CONCLUSIONS

I, COMPARISON OF EXISTING AND MODEL PLANTS

In the analyses of the data on the existing and model plants all of the different phases of the operations usually conducted by snap bean processing plants and the associated costs were discussed. Model plants were developed in order to point out the potential for improvement in the existing plants and to do more detailed economic analyses.

Considerable excess capacity was found in the snap bean processing plants which were studied. In Table XXIV it is observed that the utilized capacities of Plants A, B, and D were 62.64, 70.78, and 69.23 per cent, respectively, with an average utilized capacity of 67.55 per cent. Plant C operated beyond full capacity but it did so by sacrificing quality and packaging, largely, in the institutional container.

The degree to which operating capacity affects the average total costs per pound can be seen by making a comparison between the existing and model plants. The average total cost per pound of the existing plants, operating at less than full capacity was greater than the average total cost per pound of all containers packaged in Model Plant III by a cost difference of .916 cent. When comparing the average total cost

TABLE XXIV

COMPARISON OF AVERAGE TOTAL COST PER POUND IN EXISTING AND MODEL PLANTS, TENNESSEE, 1965

Plant	Output (Pounds)	Hours	Capacity (Per cent)	Average Total Cost (Cents)
A	3,137,307	896	62.64	9.038
B	2,940,648	568	70.78	9.096
D	9,366,598	1,735	69.23	7.030
Average	5,148,184	1,066	67.55	8.388
Model Plant III	4,500,000	1,000	75.00	7.472
C	2,227,120	651	107.75[b]	7.441[a]
Model Plant II	2,400,000	800	100.00	7.463[a]

[a]Comparison is based upon the cost of packaging institutional cut snap beans.

[b]The snipping rate of Plant C was 1077.50 pounds of input per hour. In this analysis full capacity of a snipper is set at 1,000 pounds of input per hour.

of packaging institutional cartons in model Plant II and existing Plant C, the average total cost per pound was lower in the existing plant by 0.022 cent. This is explained by the fact that the model plant is packaging a higher quality product at only 0.022 cent more than the cost per pound for Plant C.

The degree to which the use of capacity affects the average total cost per pound depends upon the capacity of the plant. For a plant with an input capacity of 2,000 pounds per hour, packaging French slice and whole beans in the retail container, the cost spread between operating at 50 and 100 per cent of capacity is 4.359 cents per pound. When a plant has an input capacity of 20,000 pounds, the cost spread under the same conditions is 1.208 cents per pound.

Labor efficiency is greater in the model plants than it was in the existing plants. Table XXV shows the comparison of number of workers and the output per man-hour for each job. Decreased average total cost per pound of output in the model plants can be partially explained by the increase in labor efficiency.

The problems in the existing plants were primarily low pack out percentage, length of packing season and excess capacity. All of these factors contribute to a higher cost per pound, and if corrected, the cost per pound of output could be lowered. Larger plants are characterized by economies of scale as was shown in the model plant analysis.

There were a number of limiting factors in the existing plants; the two most common were inadequate freezing facilities and lack of

TABLE XXV

COMPARISON OF LABOR EFFICIENCY, BASED ON THE NUMBER OF WORKERS, AND OUTPUT PER MAN-HOUR IN EXISTING AND MODEL PLANTS, TENNESSEE, 1965

Job	Existing Plants		Model Plants	
	Average No. of Workers	Average Output per man hr. (Lb./hr.)	Average No. of Workers	Average Output per man hr. (Lb./hr.)
Receiving and preparation	32	134	23	324
Packaging				
Retail French slice	20	165	16	175
Cut	13	244	12	292
Whole	--[b]	---	16	175
Institutional French slice	20	194	14	250
Cut	15	268	11	364
Whole	--	---	14	250
Bulk	7	494	8	700
Polybag	13	174	6	333
Casing	10	654	9	900

[a]Comparison of Table XII (Existing) and XXII (Model).

[b]Only one existing plant packaged whole beans, and its crew and rate of output was approximately the same as the crew and rate of output for packaging French slice snap beans.

adequate processing equipment for critical operations. If output must be varied, the hours of operation can be varied and produce the same results at a lower cost. As is pointed out in the model plant analysis on length of processing season, the plants with a smaller input capacity can obtain considerable economies by lengthening the processing season. This potential exists in Plants A, B, and C.

II. SOME SUGGESTIONS FOR INCREASING EFFICIENCY

If Tennessee processors of snap beans do not process at a lower cost than surrounding processors in other states, they are going to be at a competitive disadvantage. When a processor in another area can process at a lower cost, then he can do either or both of two things; he can sell his processed product at a lower price in his own market area, or he can move his product into markets that he formerly could not serve because of transportation costs. Either way, processors of snap beans stand to lose some of their market if they do not make every attempt to reduce costs. Some possible methods to be considered for reducing processing costs include:

1. Increasing the percentage of pack out. The beans could be graded at the processing plants so that price is directly related to quality. A minimum pack out of 80 per cent would be desirable.

2. Reducing the amount of wastage of beans in processing and in storage.

3. Removing any bottlenecks or limiting factors which prevent the plant from reaching full capacity. Addition of freezing facilities to allow the plants to operate at full capacity would eliminate a major bottleneck in the existing plants.

4. Increasing the length of the processing season would reduce the cost per pound. Processing beans from nearby states would be of assistance in lengthening the season. It would be necessary for processors to contract with producers to have an orderly flow of the product to the processing plant.

5. The newest type of equipment could be used if it is more efficient. The plant layout could be adapted to the building and whenever this is impracticable a new building could be constructed.

6. Efforts can be made to minimize break-down time which would decrease processing costs considerably.

7. If the processors want to improve the industry in Tennessee and to maintain Tennessee's share of the national market and keep it growing, some cooperative efforts in trying to reduce costs might be considered.

8. There are internal economies of scale which may be dependent on appropriate adjustment of scale of plant to each successive output. Specific variable cost inputs were held constant in the analysis of the model plants. With an assumption of constant variable costs the long-run average costs would decline virtually to a constant cost curve.

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APPENDIXES

APPENDIX A

SUPPLEMENTAL DATA

TABLE XXVI

NUMBER OF WORKERS AND PROCESSING LABOR COST BY JOBS IN PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

Job	Plant A				Plant B			
	Number of workers	Output per man hour	Total man-hours	Labor cost	Number of workers	Output per man hour	Total man-hours	Labor cost
		Lbs.		Dollars		Lbs.		Dollars
Receiving and preparation	35	100	31,373	39,216	35	143	19,865	24,831
Packaging								
Retail French slice	23	100	8,027	10,034	16	103	6,011	7,514
Institutional French slice	18	193	2,895	3,619	17	190		
Retail cut	22	104	4,686	5,858	8	206		
Institutional cut	16	217	2,373	2,966	17	190	7,418	9,273
Bulk	10	336	1,743	2,179	4	767	1,059	1,324
Polybag	17	175	1,534	1,918				
Casing[a]	12	500	4,566	5,707	13	767	2,638	3,297
USDA inspection[b]	1		1,120	6,720	1		710	4,260
Clean-up[c]	1		1,075	1,344	1		682	853
Mechanics[d]	2		3,568	7,136	2		2,272	4,544
Foremen[e]	1		1,120	1,568	2		1,420	1,988
Total labor cost[f]				88,265				57,384

TABLE XXVI (continued)

Job	Plant C				Plant D			
	Number of workers	Output per man hour	Total man-hours	Labor cost	Number of workers	Output per man hour	Total man-hours	Labor cost
		Lbs.		Dollars		Lbs.		Dollars
Receiving and preparation	18	190	11,722	14,653	41	132	70,959	88,699
Packaging								
Retail French slice					20	290	11,340	14,175
Institutional French slice	16	188	970	1,212	27	202	3,764	4,705
Retail cut					10	580	2,699	3,374
Institutional cut	16	228	8,461	10,577	10	544	394	493
Bulk	6	550	210	263	7	518	3,695	4,619
Polybag					6	250	6,080	7,600
Casing[a]	4	375	5,631	7,039	10	800	7,416	9,270
USDA inspection[b]	1		814	4,884	1		2,169	13,014
Clean-up[c]	1		781	976	6		12,492	15,615
Mechanics[d]	1		1,302	2,604	4		13,880	27,760
Foremen[e]	1		814	1,140	1		2,169	3,037
Total labor cost[f]				43,348				192,361

[a]All product was cased except bulk and polybags.

[b]Inspection rate is $6.00 per hour. Total working hours for the USDA inspector are estimated at 125 per cent of the total hours spent on receiving and preparation.

[c]Clean-up rate is same as other labor, $1.25 per hour. Total hours are estimated at 120 per cent of the total hours spent on receiving and preparation.

[d]Mechanics are paid at the rate of $2.50 per hour. Total hours are estimated at 200 per cent of the total hours utilized on receiving and preparation.

TABLE XXVI (continued)

[e]Rate of pay for foremen is $1.40 per hour. Total hours are estimated at 125 per cent of the total hours spent on receiving and preparation.

[f]All wages include FICA (3-5/8 per cent) plus Tennessee unemployment insurance (2.7 per cent) for a total of 6.325 per cent.

TABLE XXVII

VARIABLE COSTS FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

	Plant A	Plant B	Plant C	Plant D	Total
			-Pounds-		
Annual volume of snap beans processed (output)	3,137,307	2,840,648	2,227,120	9,366,598	17,571,673
Cost			-Dollars-		
Processing labor[a]	88,265	57,384	43,348	192,361	381,358
Container[b]	52,250	51,196	26,970	213,868	344,284
Freezing and storage[c]	10,981	9,942	7,795	32,783	61,501
In-plant transportation[d]	3,137	2,841	2,227	9,367	17,572
Utilities[e]					
Electricity	798	827	411	1,367	3,403
Water	5,240	5,170	5,026	6,688	22,124
Gas	2,055	2,638	1,241	3,927	9,861
Brokerage[f]	21,961	19,885	15,590	65,566	123,002
Miscellaneous general expense[g]	11,425	11,425	11,425	11,425	45,700
Total variable costs	196,112	161,308	114,033	537,352	1,008,805

[a]Includes payroll taxes @ 6.675 per cent.

[b]Container costs were obtained from a plant's accounting department.

[c]Freezing and storage is standardized at 35 cents per 100 pounds which is the commercial rate charged by a cold storage facility. This charge includes the tunnel or initial freezing.

[d]In-plant transportation is estimated at 10 cents per 100 pounds.

[e]All utility rates were obtained from the Knoxville Utilities Borad, Knoxville, Tennessee. For a detailed breakdown, see Appendix C.

[f]Brokerage is estimated at 70 cents per 100 pounds.

[g]Miscellaneous general expenses are standardized for all plants. For a detailed listing of items contained in miscellaneous general expense, see Table XXX, page 110.

TABLE XXVIII

TOTAL FIXED COSTS FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

	Plant A	Plant B	Plant C	Plant D	Total
			Pounds		
Annual volume of snap beans processed (output)	3,137,307	2,840,648	2,227,120	9,366,598	17,571,673
Cost			Dollars		
Plant equipment[a]	42,404	47,015	18,903	56,407	164,729
Building[b]	11,243	16,274	8,795	20,992	57,304
Shop equipment[c]	416	416	416	416	1,664
Laboratory equipment[d]	306	306	306	306	1,224
Office equipment[e]	782	782	782	782	3,128
Administrative expense	32,300	32,300	22,500	42,300	129,400
Total fixed cost	87,451	97,093	51,702	121,203	357,449

[a,c,d,e]Based on installed or replacement cost.

[b]Based on building replacement cost.

TABLE XXIX

ANNUAL TOTAL COSTS FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

Plant	Annual volume of snap beans processed (output)	Total variable cost	Total fixed cost	Total cost
	Pounds		Dollars	
A	3,137,307	196,112	87,451	283,563
B	2,840,648	161,308	97,093	258,401
C	2,227,120	114,033	51,702	165,735
D	9,366,598	537,352	121,203	658,555
Total	17,571,673	1,008,805	357,449	1,366,254

TABLE XXX

STANDARDIZED MISCELLANEOUS GENERAL EXPENSES IN PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

Item	Cost
Office supplies	$ 950.00
Operating supplies	1,750.00
Glue	400.00
Stitching wire	700.00
Telephone and telegraph	1,600.00
Termite Control	250.00
Insurance (Group life and hospital)	500.00
Plant travel	1,500.00
Advertising	100.00
Donations	100.00
Due and subscriptions	175.00
Legal and audit	1,000.00
Bank charges	400.00
Soap, cleaning material and disinfectants	1,000.00
Entertainment	250.00
Uncollectable accounts	750.00
Total	$11,425.00

TABLE XXXI

EQUIPMENT REQUIREMENTS AND INSTALLED COST FOR MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1965

Item	Plant II		Plant V		Plant X	
	Units required	Installed cost	Units required	Installed cost[a]	Units required	Installed cost
		Dollars		Dollars		Dollars
Floor scales	1	1,250	1	1,250	1	1,250
Dump unloader	1	2,000	1	2,000	1	2,000
Cluster cutter	1	4,250	1	4,250	2	8,500
Cleaner (trash blower)	1	150	1	150	2	300
Washer and destoner	1	4,500	1	4,500	2	9,000
Snipper	4	15,308	10	38,270	20	76,540
Unsnipped bean separator	3	4,320	8	8,640	12	17,282
Inspection belt	3	3,000	6	6,000	12	12,000
Double bar grader	2	4,150	5	10,375	10	20.750
Cutter	2	3,012	4	6,024	8	12,048
Shaker separator (nubbin grader)	1	1,897.50	2	3,795	4	7,590
Blancher (center tube 18')	2	20,000	2	20,000	4	40,000
Separator (dewaterer and cooler)	2	2,350	2	2,350	4	4,700
Single bar grader	--	--	--	--	4	5,900
Whole bean sizer	--	--	--	--	2	7,440
Slicer (French style)	1	5,070	1	5,070	3	15,210
Seed remover (shaker)	1	3,000	1	3,000	2	6,000
Carton former	2	12,000	4	24,000	5	30,000
Holding bin and table packing	2	500	2	500	3	750
Mechanical sorting scales	2	1,800	4	3,600	5	4,500

TABLE XXXI (continued)

Item	Plant II Units required	Plant II Installed cost	Plant V Units required	Plant V Installed cost[a]	Plant X Units required	Plant X Installed cost
		Dollars		Dollars		Dollars
Partial bean line	2	5,874	4	11,748	5	14,685
Exact weight scale	10	1,070	19	2,033	25	2,675
Carton closer	2	16,000	4	32,000	5	40,000
Wrapper	2	20,634	4	41,268	5	51,585
Mechanical filler (cuts)	2	12,250	2	12,250	2	12,250
Tray-off table	3	100	4	200	5	250
Hand truck	3	610.50	5	1,017.50	8	1,628
Bin and cluster breaker	--	--	1	400	1	400
Platform scale	--	--	1	129	1	129
Stitcher	--	--	1	396	1	396
Stenciler (mechanical)	1	1,140	1	1,140	1	1,140
Stapler	1	150	2	300	2	300
Stenciler (hand)	1	307	1	307	2	614
Case out table	1	233	1	233	1	233
Case closer and sealer (mechanical)	1	1,250	1	1,250	1	1,250
Polybag filler (mechanical)	--	--	1	6,036	1	6,036
Boiler[b]	54 BHP	5,000	54 BHP	5,000	108 BHP	9,500
Stainless steel truck	1	264	2	528	4	1,056
Platform for support of processing equipment	1	3,000	1	6,000	1	1,100
Battery powered forklift	1	5,500	2	11,000	3	16,500
Water fountain	1	204	1	204	2	408
Steel pallets	60	259.80	150	649.50	300	1,299
Freezer trays	1500	1,500	3750	3,750	7500	7,500

TABLE XXXI (continued)

Item	Plant II Units required	Plant II Installed cost	Plant V Units required	Plant V Installed cost	Plant X Units required	Plant X Installed cost
		Dollars		Dollars		Dollars
Racks (IQF)	--	--	40	600	40	600
Flat trays (IQF)	--	--	1600	3,200	1600	3,200
Pitch forks	1	5	1	5	2	10
Food pump	--	--	1	1,588	2	3,176
Vibrating conveyor	1-30'	1,300	1-60'	1,700	2-110'	5,800
Detrash reel and washer	--	--	1	458	2	916
Holding bins (small)	10	100	19	190	25	250
Disposal unit	1	1,200	1	2,000	1	5,500
Adding machine	1	250	1	250	2	500
Swivel bin	1	500	2	1,000	2	1,000
Cross conveyor[d]	3-75'	7,500	3-183'	18,000	3-363'	35,100
Flight conveyor[d]	3-30'	3,000	3-30'	3,000	3-30'	3,000
Cross conveyor[d]	4-64'	3,600	4-160'	7,600	6-320'	21,600
Feed conveyor[d]	2-20'	1,700	2-20'	2,550	4-56'	5,600
Total equipment cost		183,058.80		323,754		548,844
Annual equipment cost[e]		30,204.42		52,429.45		90,559.29

[a]Includes f.o.b. costs, transportation, and installation including plumbing, electrical work and sales tax.

[b]Estimated boiler requirements are based upon 27 BHP per blancher.

[c,d]Robert H. Reed and L. L. Sammett, Multiple-Product Processing of California Frozen Vegetables, Giannini Foundation Research Report No. 264 (Berkeley: University of California, 1963), p. 190.

[e]Annual equipment charge is 16.5 per cent of the installed cost with the following breakdown: depreciation, 10 per cent; interest on investment, 3.0 per cent (approximately 5.5 per cent of undepreciated balance); taxes, 1.0 per cent; insurance, 1.0 per cent; and repairs, 1.5 per cent.

TABLE XXXII

OFFICE EQUIPMENT FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

Item of equipment	Replacement costs[a]	Use life	Annual fixed cost[b]
No. required			
1 - 2-drawer file cabinet	$ 83	10	14
2 - 4-drawer file cabinet	240	10	40
1 - 3-drawer file cabinet	110	10	18
2 - Executive desk	519	10	86
2 - Swivel chair	145	10	24
2 - Sidearm chair	80	10	13
2 - Secretarial desk	214	10	35
2 - Printing calculators	1,046	10	173
3 - Straight chairs	15	10	2
1 - Manual typewriter	88	10	15
1 - Electric typewriter	325	10	54
1 - Adding machine	275	10	45
1 - Safe	150	10	25
1 - Duplicating machine	175	10	29
1 - Checkwriter	35	10	6
2 - Heaters	73	10	12
1 - Air-conditioner	225	10	37
3 - Waste baskets	6	10	1
1 - Metal wall locker	135	10	22
10 - Light fixtures	700	10	116
3 - Desk lamps	90	10	15
Total	$4,729		782

[a]Replacement cost was obtained from plant inventories.

[b]Annual fixed cost includes interest on investment, 3.0 per cent (approximately 5.5 per cent of undepreciated balance), taxes, 1.0 per cent, insurance, 1.0 per cent, repairs, 1.5 per cent, and depreciation, 10.0 per cent.

TABLE XXXIII

LABORATORY EQUIPMENT FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

Item of equipment	Replacement cost[a]	Use life	Annual fixed cost[b]
No. required			
1 - 4-drawer file cabinet	$ 240	10	40
1 - Desk	112	10	18
1 - Table	50	10	8
1 - Swivel chair	72	10	12
2 - Sidearm chairs	80	10	13
1 - Gas range	120	10	20
1 - Metal wall locker	135	10	22
1 - Exact weight scale	185	10	31
1 - Manual typewriter	88	10	15
1 - Microscope	175	10	29
1 - Electric timer	20	10	3
1 - Desk lamp	30	10	5
1 - Blender	45	10	7
1 - Air-conditioner	125	10	21
1 - Sink, 66 in. stainless steel top	325	10	54
5 - Thermometers	10	10	2
5 - Flat porcelain trays 12 x 18	13	10	2
Miscellaneous (pots, pans, & etc.)	25	10	4
Total	$1,850		306

[a]Replacement cost was obtained from plant inventories.

[b]Annual fixed cost includes interest on investment 3.0 per cent (approximately 5.5 per cent of undepreciated balance), taxes, 1.0 per cent, insurance, 1.0 per cent, repairs, 1.5 per cent, and depreciation, 10.0 per cent.

TABLE XXXIV

SHOP EQUIPMENT FOR PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1963

Item of equipment	Replacement cost[a]	Use life	Annual fixed cost[b]
No. required			
1 - Battery charger	300	10	50
1 - AC-DC generator	350	10	58
1 - Electric welder	612	10	101
1 - Autylene welder	109	10	18
1 - Pipe vise	76	10	13
1 - Portable grinder	59	10	10
1 - Bench vise	76	10	13
1 - 8' stepladder	30	10	5
2 - 12' stepladders	68	10	11
1 - Paint spray gun	142	10	23
1 - Pipe threader	50	10	8
1 - Miscellaneous hand tools (set)	150	10	25
1 - Drill press	145	10	24
1 - Bolt die set	30	10	5
1 - Portable light	10	10	2
1 - Metal lathe	300	10	50
Total	2,507		416

[a]Replacement cost was obtained from plant inventories.

[b]Annual fixed cost includes interest on investment 3.0 per cent (approximately 5.5 per cent of undepreciated balance), taxes, 1.0 per cent, insurance, 1.0 per cent, repairs, 1.5 per cent, and depreciation, 10.0 per cent.

TABLE XXXV

CREW REQUIREMENTS IN RECEIVING AND PREPARATION STAGE AND OUTPUT PER MAN HOUR FOR MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1965

	Receiving and preparation													
Plant	Grade and weigh	Un-load	Feed and attend snippers	Inspect after unsnipped separates	Attend cutters and clean-up	Attend nubbin grader	Attend double grader	Attend single grader	Attend blancher and clean-up	Attend French slicer	Transport beans to processing line	Total	Output per hr.	Out-put/ man hr.
I	1	1	1	4	1	1	--	--	1	--	--	10	1,500	150
II	1	1	1	6	1	1	--	--	1	1	1	14	3,000	214
III	1	1	1	8	1	1	--	--	1	1	1	16	4,500	281
IV	1	1	1	10	1	1	1	--	1	1	2	20	6,000	300
V	1	1	1	12	1	1	1	--	1	1	2	22	7,500	341
VI	1	1	1	16	1	1	1	1	2	1	3	29	9,000	310
VII	1	2	1	18	1	1	1	1	2	1	3	32	10,500	328
VIII	1	2	1	20	1	1	1	1	2	1	3	34	12,000	353
IX	1	2	1	22	1	1	1	1	3	1	4	38	13,500	355
X	1	2	1	24	1	1	1	1	3	1	4	40	15,000	375

TABLE XXXVI

STANDARDIZED CREW REQUIREMENTS AND OUTPUT PER MAN HOUR FOR PACKAGING OPERATION FOR MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1965

Processing operation	Crew			Output per hr.	Output per man per.
	Men	Women	Total		
Retail (French slice and whole)	5	11	16	2,800	175
Attend carton former	1		1		
Supply and clean-up	1		1		
Attend fill		3	3		
Adjust carton weight		6	6		
Attend carton closer		1	1		
Attend wrapper		1	1		
Tray-off	2		2		
Haul trays	1		1		
Retail (cuts)	6	6	12	3,500	292
Attend carton former	1		1		
Supply and clean-up	1		1		
Attend fill	1		1		
Adjust carton weight		4	4		
Attend carton closer		1	1		
Attend wrapper		1	1		
Tray-off	2		2		
Haul trays	1		1		
Institutional (French slice and whole)	5	9	14	3,500	250
Attend carton former	1		1		
Supply and clean-up	1		1		
Attend fill		3	3		
Adjust carton weight		4	4		
Attend carton closer		1	1		
Attend wrapper		1	1		
Tray-off	2		2		
Haul trays	1		1		

TABLE XXXVI (continued)

Processing operation	Crew			Output per hr.	Output per man hr.
	Men	Women	Total		
Institutional (cuts)	6	5	11	4,000	364
Attend carton former	1		1		
Supply and clean-up	1		1		
Attend carton fill	1		1		
Adjust carton weight		3	3		
Attend carton closer		1	1		
Attend wrapper		1	1		
Tray-off	2		2		
Haul trays	1		1		
Polybag	4	2	6	2,000	333
Fill bin	1		1		
Checkweigh and remove improperly sealed bags		2	2		
Stencil and form cases	1		1		
Tray off and stack cases	1		1		
Haul cases	1		1		
Bulk (IQF)	8		8	5,600	700
Haul trays	1		1		
Fill bin to cluster	2		2		
Place liners	1		1		
Fill and weigh bag	2		2		
Sew bag	1		1		
Stack bags on skid	1		1		
Case	6	3	9	8,100	900
Stencil and form cases	1		1		
Haul trays	1		1		
Place trays on rack casing	1		1		
Fill cases		3	3		
Stack cases on skid	1		1		
Remove empty trays to skid	1		1		
Haul cases	1		1		

TABLE XXXVII

CREW REQUIREMENTS FOR MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1965

Job	Plant II			Plant V			Plant X		
	M	W	T	M	W	T	M	W	T
Receiving and preparation	8	6	14	10	12	22	16	24	40
Packaging									
Retail (French)	5	11	16	5	11	16	5	11	16
Retail (Whole)	-	--	--	-	--	--	5	11	16
Retail (Cut)	6	6	12	6	6	12	6	6	12
Institutional (French)	5	9	14	5	9	14	5	9	14
Institutional (Whole)	-	--	--	-	--	--	5	9	14
Institutional (Cut)	6	5	11	6	5	11	6	5	11
Polybag (IQF)	-	--	--	4	2	6	4	2	6
Bulk (IQF)	-	--	--	8	--	8	8	--	8
Case	6	3	9	6	3	9	6	3	9
Clean-up	1	--	1	2	--	2	4	--	4
USDA Inspector	1	--	1	1	--	1	2	--	2
Mechanics	1	--	1	2	--	2	3	--	3
Foremen	1	--	1	2	--	2	3	--	3
Total	40	40	80	57	48	105	78	80	158

TABLE XXXVIII

HORSEPOWER SPECIFICATIONS FOR EQUIPMENT IN MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1965

Item	Plant II		Plant V		Plant X	
	Units required	Total horsepower	Units required	Total horsepower	Units required	Total horsepower
Cluster cutter	1	1 2/4	1	1 2/4	2	3
Cleaner (trash blower)	1	2/4	1	2/4	2	1
Washer and destoner	1	1 2/4	1	1 2/4	2	3
Snippers	4	5	10	12 2/4	20	25
Unsnipped bean separator	3	3	6	6	12	12
Inspection belt	3	1 1/2	6	3	12	6
Double bar grader	2	1 1/2	5	3 3/4	10	7 2/4
Cutter	2	2	4	4	8	8
Shaker separator (nubbin grader)	1	3/4	2	1 2/4	4	3
Blancher (center tube 18')	2	4	2	4	4	8
Separator (dewaterer and cooler)	2	1 2/4	2	1 2/4	4	3
Single bar grader	-	-	-	-	4	3
Whole bean sizer	-	-	-	-	2	1 2/4
Slicer (French style)	1	1	1	1	3	3
Seed remover (shaker)	1	3/4	1	3/4	2	1 2/4
Carton former	2	2	4	4	5	5
Mechanical sorting scale	2	2/4	4	1	5	1 1/4
Partial bean line	2	2	4	4	5	5
Carton closer	2	2	4	4	5	5
Wrapper	2	2	4	4	5	5

TABLE XXXVIII (continued)

Item	Plant II Units required	Plant II Total horsepower	Plant V Units required	Plant V Total horsepower	Plant X Units required	Plant X Total horsepower
Mechanical filler (cuts)	2	1	2	1	2	1
Bin and cluster breaker	-	1	1	2/4	1	2/4
Stitcher	-	-	1	1/4	1	1/4
Stenciler (mechanical)	1	2/4	1	2/4	1	2/4
Stapler	1	1/4	2	2/4	2	2/4
Case closer and sealer (mechanical)	1	3/4	1	3/4	1	3/4
Polybag filler (mechanical)	-	-	1	1	1	1
All conveyors		12		16		29
Cross conveyors	3-75'	6	3-183'	9	3-363'	15
Flight conveyors	3-30'	3	3-30'	3	3-30'	3
Cross conveyors	4-64'	2	4-160'	3	6-320'	9
Feed conveyors	2-20'	1	2-20'	1	4-56'	2
Food pump	-	-	1	5	2	10
Vibrating conveyor	1-30'	3/4	1-60'	3/4	2-110'	1 2/4
Disposal unit	1	1	1	1	1	2
Total horsepower		49 1/4		85 3/4		156 3/4

TABLE XXXIX

ELECTRICITY REQUIRED AND TOTAL COST OF ELECTRICITY FOR EACH MODEL PLANT PROCESSING SNAP BEANS FOR FREEZING AT 100 PER CENT CAPACITY WITH VARYING PROCESSING PERIODS OF 800, 1000, 1600, 1800 AND 2000 HOURS

Plant	Demand in kilowatts per hour[a]	Length of processing period: 800		1000		1600		1800		2000	
		Total kws. used	Total cost[b]	Total kws. used	Total cost	Total kws. used	Total cost	Total kws. used	Total cost	Total kws. used	Total cost
			Dollars		Dollars		Dollars		Dollars		Dollars
I	28	21,900	457	27,375	474	43,800	526	49,275	543	54,750	560
II	36	28,762	574	35,953	600	57,524	669	64,715	690	71,905	713
III	52	40,880	848	51,100	880	81,760	977	91,980	1,009	102,200	1,041
IV	59	44,384	913	55,480	949	88,768	1,054	99,864	1,089	110,960	1,125
V	63	47,158	964	58,948	1,002	94,316	1,114	106,106	1,150	117,895	1,188
VI	84	61,320	1,218	76,650	1,304	122,640	1,452	137,970	1,500	153,300	1,548
VII	89	65,262	1,339	81,578	1,391	130,524	1,545	146,840	1,597	163,155	1,648
VIII	96	70,810	1,453	88,513	1,509	141,620	1,677	159,323	1,733	177,025	1,789
IX	108	80,592	1,649	100,740	1,713	161,184	1,905	181,332	1,968	201,480	2,031
X	115	85,702	1,762	107,128	1,830	171,404	2,034	192,830	2,101	214,255	2,169

[a]Total horsepower required in a plant X .730 = demand in kilowatts per hour. Source: J. J. Moder, Jr. and N. M. Penny, Industrial Engineering and Economic Studies of Peanut Marketing, Engineering Experiment Station Bulletin No. 286 (Atlanta: Georgia Institute of Technology, 1954), p. 154.

[b]Knoxville Utilities Board rates are used. An added charge of 15 per cent is provided for plant lighting and office electricity use.

TABLE XL

GAS REQUIRED AND TOTAL COST OF GAS FOR EACH MODEL PLANT PROCESSING SNAP BEANS FOR FREEZING AT 100 PER CENT CAPACITY WITH VARYING PROCESSING PERIODS OF 800, 1000, 1600, 1800 AND 2000 HOURS

Plant	Demand in therms per day	Length of processing period: 800 — Total therms of gas required[a]	800 — Total cost[b]	1000 — Total therms of gas required	1000 — Total cost	1600 — Total therms of gas required	1600 — Total cost	1800 — Total therms of gas required	1800 — Total cost	2000 — Total therms of gas required	2000 — Total cost
			Dollars		Dollars		Dollars		Dollars		Dollars
I	73	7,232	1,215	9,040	1,330	14,463	2,392	16,271	2,507	18,074	2,623
II	145	14,463	2,392	18,079	2,623	28,926	4,750	32,542	4,981	36,158	5,212
III	145	14,463	2,392	18,079	2,623	28,926	4,750	32,542	4,981	36,158	5,212
IV	145	14,463	2,392	18,079	2,623	28,926	4,750	32,542	4,981	36,158	5,212
V	145	14,463	2,392	18,079	2,623	28,926	4,750	32,542	4,981	36,158	5,212
VI	217	21,695	3,567	27,118	3,912	43,389	7,099	48,813	7,445	54,236	7,791
VII	217	21,695	3,567	27,118	3,912	43,389	7,099	48,813	7,445	54,236	7,791
VIII	217	21,695	3,567	27,118	3,912	43,389	7,099	48,813	7,445	54,236	7,791
IX	290	28,926	4,750	36,158	5,212	57,857	9,457	65,084	9,918	72,315	10,380
X	290	28,926	4,750	36,158	5,212	57,857	9,457	65,084	9,918	72,315	10,830

[a] Total therms of gas required is equal to $\frac{\text{BHP} \times 33{,}479\ (\text{BTU/BHP})}{100{,}000}$ x hours operated. There are 100,000 BTU's in a therm of gas.

[b] Knoxville Utilities Board rates are used. An added charge of 10 per cent is provided for heating of any part of the plant and office.

TABLE XLI

WATER REQUIRED AND TOTAL COST OF WATER FOR EACH MODEL PLANT PROCESSING SNAP BEANS FOR FREEZING AT 100 PER CENT CAPACITY WITH VARYING PROCESSING PERIODS OF 800, 1000, 1600, 1800, AND 2000 HOURS

Plant	Demand in cubic feet per day[a]		Length of processing season									
			800		1000		1600		1800		2000	
			Total cu. ft. used	Total cost	Total cu. ft. used	Total cost	Total cu. ft. used	Total cost	Total cu. ft. used	Total cost.	Total cu. ft. used	Total cost
	8 hr.	16 hr.		Dollars		Dollars		Dollars		Dollars		Dollars
I	6,744	13,488	647,133	4,863	842,667	4,972	1,348,267	5,255	1,516,800	5,350	1,685,334	5,444
II	13,480	26,960	1,348,267	5,255	1,685,334	5,444	2,696,534	6,010	3,033,600	6,199	3,370,667	6,388
III	20,240	40,480	2,024,534	5,634	2,530,667	5,918	4,049,067	6,768	4,555,200	7,051	5,061,334	7,335
IV	27,024	54,048	2,702,934	6,014	3,378,667	6,392	5,405,867	7,528	6,081,600	7,906	6,757,334	8,285
V	33,808	67,616	3,381,334	6,394	4,226,667	6,867	6,762,667	8,287	7,608,000	8,761	8,453,334	9,234
VI	40,720	81,540	4,072,534	6,781	5,090,667	7,351	8,145,067	9,454	9,163,200	9,524	10,181,334	10,594
VII	47,632	95,264	4,763,734	7,168	5,954,667	7,835	9,527,467	11,040	10,718,400	11,707	11,909,867	12,374
VIII	54,672	109,344	5,467,734	7,562	6,834,667	8,328	10,935,467	12,685	12,302,400	13,451	13,669,334	14,216
IX	61,840	123,680	6,184,534	7,964	7,730,667	8,830	12,369,067	14,348	13,915,200	15,214	15,461,334	16,080
X	69,008	138,016	6,901,334	8,365	8,626,667	9,331	13,802,667	16,010	15,528,000	16,876	17,253,334	17,942

[a]Note: The requirement is considered the same for a 1000 pounds of input as 1000 pounds of output, Robert H. Reed and L. L. Sammet, Multiple-Product Processing of California Frozen Vegetables, Giannini Foundation Research Report No. 264 (Berkeley: University of California, 1963), p. 46.

[b]Knoxville Utilities Board rates are used.

TABLE XLII

TOTAL OUTPUT BY LENGTH OF SEASON AND VARYING CAPACITY FOR MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING, TENNESSEE, 1965

Length of season	Operating capacity	Output									
		Plant I	Plant II	Plant III	Plant IV	Plant V	Plant VI	Plant VII	Plant VIII	Plant IX	Plant X
- Hours -		- - - - - - - - - - 1000 Pounds - - - - - - - - - -									
800	100	1,200	2,400	3,600	4,800	6,000	7,200	8,400	9,600	10,800	12,000
	75	900	1,800	2,700	3,600	4,500	5,400	6,300	7,200	8,100	9,000
	50	600	1,200	1,800	2,400	3,000	3,600	4,200	4,800	5,400	6,000
1000	100	1,500	3,000	4,500	6,000	7,500	9,000	10,500	12,000	13,500	15,000
	75	1,175	2,250	3,375	4,500	5,625	6,750	7,875	9,000	10,125	11,250
	50	750	1,500	2,250	3,000	3,750	4,500	5,250	6,000	6,750	7,500
1600	100	2,400	4,800	7,200	9,600	12,000	14,400	16,800	19,200	21,600	24,000
	75	1,800	3,600	5,400	7,200	9,000	10,800	12,600	14,400	16,200	18,000
	50	1,200	2,400	3,600	4,800	6,000	7,200	8,400	9,600	10,800	12,000
1800	100	2,700	5,400	8,100	10,800	13,500	16,200	18,900	21,600	24,300	27,000
	75	2,025	4,050	6,075	8,100	10,125	12,150	14,175	16,200	18,225	20,250
	50	1,350	2,700	4,050	5,400	6,750	8,100	9,450	10,800	12,150	13,500
2000	100	3,000	6,000	9,000	12,000	15,000	18,000	21,000	24,000	27,000	30,000
	75	2,250	4,500	6,750	9,000	11,250	13,500	15,750	18,000	20,250	22,500
	50	1,500	3,000	4,500	6,000	7,500	9,000	10,500	12,000	13,500	15,000

TABLE XLIII

AVERAGE FIXED COSTS PER POUND OF PROCESSING SNAP BEANS BY LENGTHS OF SEASON, AND CAPACITY UTILIZED IN MODEL PLANTS, TENNESSEE, 1965

Length of season	Capacity	Plant									
		I	II	III	IV	V	VI	VII	VIII	IX	X
- Hours -		Cents									
800	50	7,962	5.293	4.191	4.082	3.535	3.301	2.947	2.875	2.818	2.618
	75	5.308	3.529	2.794	2.721	2.357	2.201	1.965	1.917	1.878	1.745
	100	3.981	2.647	2.095	2.041	1.768	1.651	1.474	1.438	1.409	1.309
1,000	50	6.370	4.235	3.353	3.266	2.818	2.641	2.358	2.300	2.254	2.095
	75	4.246	2.823	2.235	2.177	1.886	1.761	1.572	1.533	1.503	1.396
	100	3.185	2.117	1.676	1.633	1.414	1.321	1.179	1.150	1.127	1.047
1,600	50	3.981	2.647	2.095	2.041	1.768	1.651	1.474	1.438	1.409	1.309
	75	2.654	1.764	1.397	1.361	1.178	1.100	.982	.958	.939	.873
	100	1.990	1.323	1.048	1.021	.884	.825	.737	.719	.704	.655
1,800	50	3.539	2.353	1.863	1.814	1.571	1.467	1.310	1.278	1.252	1.164
	75	2.359	1.568	1.242	1.209	1.048	1.100	.873	.852	.835	.776
	100	1.769	1.176	.931	.907	.786	.825	.655	.639	.626	.582
2,000	50	3.185	2.117	1.676	1.633	1.414	1.321	1.179	1.150	1.127	1.047
	75	2.123	1.412	1.118	1.089	.943	.880	.786	.767	.751	.698
	100	1.592	1.059	.838	.816	.707	.660	.589	.575	.564	.524

TABLE XLIV

AVERAGE TOTAL COSTS PER POUND OF PROCESSING SNAP BEANS BY VARIOUS TYPES OF PACK, AND CAPACITY UTILIZED IN MODEL PLANTS OPERATING 800 HOURS, TENNESSEE, 1965

Type of pack	Capacity	Plant									
		I	II	III	IV	V	VI	VII	VIII	IX	X
		Cents									
Retail	50	17.075	12.444	10.489	10.123	9.389	9.135	8.650	8.501	8.395	8.123
French slice	75	13.478	10.189	8.755	8.510	8.007	7.858	7.514	7.408	7.331	7.138
and whole	100	11.672	9.053	7.889	7.704	7.318	7.219	6.948	6.862	6.799	6.646
Institutional	50	15.651	11.020	9.065	8.708	7.965	7.711	7.226	7.077	6.971	6.699
French slice	75	12.049	8.765	7.331	7.095	6.583	6.434	6.090	5.984	5.907	5.714
and whole	100	10.248	7.629	6.465	6.289	5.892	5.795	5.524	5.438	5.375	5.222
Retail cut	50	16.931	12.300	10.345	9.988	9.245	8.991	8.506	8.357	8.251	7.979
	75	13.329	10.045	8.611	8.375	7.863	7.714	7.370	7.264	7.187	6.994
	100	11.528	8.909	7.745	7.569	7.172	7.075	6.804	6.718	6.655	6.502
Institutional cut	50	15.485	10.854	8.899	8.542	7.799	7.545	7.060	6.911	6.805	6.533
	75	11.883	8.599	7.165	6.929	6.417	6.268	5.924	5.818	5.741	5.548
	100	10.082	7.463	6.299	6.123	5.726	5.629	5.358	5.272	5.209	5.056
Polybag	50	20.436	15.805	13.850	13.493	12.750	12.496	12.011	11.862	11.756	11.484
	75	16.834	13.550	12.116	11.880	11.368	11.219	10.875	10.769	10.692	10.499
	100	15.033	12.414	11.250	11.074	10.677	10.580	10.309	10.223	10.160	10.007
Bulk bag	50	14.237	9.606	7.659	7.294	6.551	6.297	5.812	5.663	5.557	5.285
	75	10.635	7.351	5.917	5.681	5.169	5.020	4.676	4.570	4.493	4.300
	100	8.834	6.215	5.051	4.875	4.478	4.381	4.110	4.024	3.961	3.808

TABLE XLV

AVERAGE TOTAL COSTS PER POUND OF PROCESSING SNAP BEANS BY VARIOUS TYPES OF PACK, AND CAPACITY UTILIZED IN MODEL PLANTS OPERATING 1000 HOURS, TENNESSEE, 1965

Type of pack	Capacity	Plant									
		I	II	III	IV	V	VI	VII	VIII	IX	X
		Cents									
Retail	50	14.953	11.125	9.479	9.183	8.572	8.376	7.995	7.869	7.782	7.557
French slice	75	12.032	9.278	8.063	7.865	7.455	7.346	7.070	6.971	6.906	6.744
and whole	100	10.594	8.373	7.368	7.220	6.899	6.834	6.608	6.533	6.480	6.349
Institutional	50	13.529	9.701	8.055	7.768	7.148	6.972	6.571	6.445	6.358	6.133
French slice	75	10.608	7.854	6.639	6.450	6.031	5.922	5.638	5.547	5.482	5.320
and whole	100	9.170	6.949	5.944	5.805	5.475	5.410	5.184	5.109	5.056	4.925
Retail cut	50	14.809	10.981	9.335	9.048	8.428	8.252	7.851	7.725	7.638	7.413
	75	11.888	9.134	7.919	7.730	7.311	7.203	6.918	6.827	6.762	6.600
	100	10.450	8.229	7.224	7.085	6.755	6.690	6.464	6.389	6.336	6.205
Institutional cut	50	13.363	9.535	7.889	7.602	6.982	6.806	6.405	6.279	6.192	5.967
	75	10.442	7.688	6.473	6.284	5.865	5.756	5.472	5.381	5.316	5.154
	100	9.004	6.783	5.778	5.639	5.309	5.244	5.018	4.943	4.890	4.759
Polybag	50	18.314	14.486	12.840	12.553	11.933	11.757	11.356	11.230	11.143	10.918
	75	15.393	12.639	11.424	11.235	10.816	10.707	10.423	10.332	10.267	10.105
	100	13.955	11.734	10.729	10.590	10.260	10.195	9.969	9.894	9.841	9.710
Bulk bag	50	12.115	8.287	6.641	6.354	5.734	5.558	5.157	5.031	4.944	4.719
	75	9.194	6.440	5.225	5.036	4.617	4.508	4.224	4.133	4.068	3.906
	100	7.756	5.535	4.530	4.391	4.061	3.996	3.770	3.695	3.642	3.511

TABLE XLVI

AVERAGE TOTAL COSTS PER POUND OF PROCESSING SNAP BEANS BY VARIOUS TYPES OF PACK, AND CAPACITY UTILIZED IN MODEL PLANTS OPERATING 1600 HOURS, TENNESSEE, 1965

Type of pack	Capacity	Plant									
		I	II	III	IV	V	VI	VII	VIII	IX	X
		Cents									
Retail	50	11.734	9.112	7.929	7.734	7.340	7.254	6.989	6.906	6.852	6.700
French slice	75	9.913	7.960	7.050	6.919	6.642	6.603	6.407	6.343	6.302	6.189
and whole	100	9.002	7.386	6.611	6.509	6.292	6.277	6.117	6.065	6.027	5.934
Institutional	50	10.310	7.688	6.505	6.319	5.916	5.830	5.565	5.482	5.428	5.276
French slice	75	8.489	6.536	5.626	5.504	5.218	5.179	4.983	4.914	4.878	4.765
and whole	100	7.578	5.953	5.187	5.094	4.838	4.853	4.693	4.641	4.603	4.510
Retail cut	50	11.590	8.968	7.785	7.599	7.196	7.110	6.845	6.762	6.708	6.556
	75	9.769	7.816	6.906	6.784	6.498	6.459	6.263	6.199	6.158	6.045
	100	8.858	7.242	6.467	6.374	6.148	6.133	5.973	5.921	5.883	5.790
Institutional cut	50	10.144	7.522	6.339	6.153	5.750	5.664	5.399	5.316	5.262	5.110
	75	8.323	6.370	5.460	5.338	5.052	5.013	4.817	4.753	4.712	4.599
	100	7.412	5.796	5.021	4.928	4.702	4.687	4.527	4.475	4.437	4.344
Polybag	50	15.095	12.473	11.290	11.104	10.701	10.615	10.350	10.267	10.213	10.061
	75	13.271	11.371	10.411	10.289	10.003	9.964	9.768	9.704	9.668	9.550
	100	12.363	10.747	9.972	9.879	9.653	9.638	9.478	9.426	9.388	9.295
Bulk bag	50	8.896	6.274	5.091	4.905	4.502	4.416	4.151	4.088	4.014	3.862
	75	7.075	5.122	4.212	4.090	3.804	3.765	3.569	3.505	3.464	3.351
	100	6.164	4.511	3.773	3.680	4.454	3.439	3.279	3.227	3.189	3.096

TABLE XLVII

AVERAGE TOTAL COSTS PER POUND OF PROCESSING SNAP BEANS BY VARIOUS TYPES OF PACK, AND CAPACITY UTILIZED IN MODEL PLANTS OPERATING 1800 HOURS, TENNESSEE, 1965

Type of pack	Capacity	Plant									
		I	II	III	IV	V	VI	VII	VIII	IX	X
		Cents									
Retail	50	11.126	8.729	7.636	7.462	7.106	7.037	6.794	6.719	6.669	6.531
French slice	75	9.508	7.706	6.754	6.735	6.487	6.580	6.279	6.219	6.181	6.076
and whole	100	8.698	7.195	6.462	6.373	6.177	6.257	6.019	5.970	5.936	5.849
Institutional	50	9.702	7.305	6.212	6.047	5.682	5.613	5.370	5.295	5.245	5.107
French slice	75	8.084	6.282	5.430	5.320	5.063	5.156	4.855	4.795	4.757	4.652
and whole	100	7.274	5.771	5.038	4.958	4.753	4.833	4.595	4.546	4.512	4.425
Retail cut	50	10.982	8.585	7.492	7.327	6.962	6.893	6.650	6.575	6.525	6.387
	75	9.364	7.562	6.710	6.600	6.343	6.436	6.135	6.075	6.037	5.932
	100	8.554	7.051	6.318	6.238	6.033	6.113	5.875	5.826	5.792	5.705
Institutional cut	50	7.536	7.039	6.046	5.881	5.516	5.447	5.210	5.129	5.079	4.941
	75	7.918	6.116	5.264	5.154	4.897	4.990	4.689	4.629	4.591	4.486
	100	7.108	5.605	4.872	4.792	4.587	4.667	4.429	4.380	4.346	4.259
Polybag	50	14.487	12.090	10.997	10.832	10.467	10.398	10.155	10.080	10.030	9.892
	75	12.869	11.067	10.215	10.105	9.848	9.946	9.640	9.580	9.542	9.437
	100	12.059	10.556	9.823	0.743	9.538	9.618	9.380	9.331	9.297	9.210
Bulk bag	50	8.288	5.891	4.798	4.633	4.268	4.199	3.956	3.881	3.831	3.693
	75	6.670	4.868	4.016	3.906	3.649	3.742	3.441	3.381	3.343	3.238
	100	5.860	4.357	3.624	3.544	3.339	3.419	3.181	3.132	3.098	3.011

TABLE XLVIII

AVERAGE TOTAL COSTS PER POUND OF PROCESSING SNAP BEANS BY VARIOUS TYPES OF PACK, AND CAPACITY UTILIZED IN MODEL PLANTS OPERATING 2000 HOURS, TENNESSEE, 1965

Type of pack	Capacity	Plant									
		I	II	III	IV	V	VI	VII	VIII	IX	X
		Cents									
Retail	50	10.678	8.459	7.431	7.270	6.945	6.895	6.666	6.594	6.548	6.419
French slice	75	9.184	7.502	6.698	6.595	6.363	6.343	6.176	6.119	6.082	5.985
and whole	100	8.455	7.041	6.346	6.263	6.080	6.082	5.942	5.895	5.861	5.781
Institution	50	9.254	7.035	6.007	5.855	5.521	5.471	5.242	5.170	5.124	4.995
French slice	75	7.760	6.078	5.274	5.180	4.939	4.919	4.752	4.695	4.658	4.561
and whole	100	7.031	5.617	4.927	4.848	4.656	4.658	4.518	4.471	4.437	4.357
Retail cut	50	10.534	8.315	7.287	7.135	6.801	6.747	6.522	6.450	6.404	6.275
	75	9.040	7.358	6.554	6.460	6.219	6.199	6.032	5.975	5.938	5.841
	100	8.311	6.897	6.202	6.128	5.936	5.938	5.798	5.751	5.717	5.637
Institutional cut	50	9.088	6.869	5.841	5.689	5.355	5.305	5.076	5.004	4.958	4.829
	75	7.594	5.912	5.108	5.014	4.773	4.753	4.586	4.529	4.492	4.395
	100	6.865	5.451	4.756	4.682	4.490	4.492	4.352	4.305	4.271	4.191
Polybag	50	14.039	11.820	10.792	10.640	10.306	10.256	10.027	9.955	9.909	9.780
	75	12.545	10.863	10.059	9.965	9.724	9.704	9.537	9.480	9.443	9.346
	100	11.816	10.402	9.707	9.633	9.441	9.443	9.303	0.256	9.222	9.142
Bulk bag	50	7.840	5.621	4.593	4.441	4.107	4.057	3.828	3.762	3.710	3.581
	75	6.346	4.664	3.860	3.766	3.525	3.505	3.338	3.281	3.244	3.147
	100	5.617	4.203	3.500	3.434	3.242	3.244	3.104	3.057	3.023	2.948

TABLE XLIX

FIXED COST PER POUND BY LENGTH OF SEASON IN MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING AT 50 PER CENT CAPACITY, TENNESSEE, 1965

Fixed factors	Plant									
	I	II	III	IV	V	VI	VII	VIII	IX	X
	Cents									
	800-hour season									
Plant equipment	3.807	2.517	2.272	2.011	1.748	1.772	1.607	1.539	1.607	1.509
Building	.854	.542	.429	.370	.334	.318	.301	.291	.282	.273
Shop equipment	.069	.035	.023	.017	.014	.012	.010	.009	.008	.008
Lab equipment	.051	.026	.017	.013	.010	.009	.007	.006	.006	.005
Office equipment	.130	.065	.043	.033	.026	.002	.019	.021	.019	.017
Administrative expense	3.050	2.108	1.406	1.637	1.403	1.169	1.002	1.008	.896	.807
Total fixed cost	7.962	5.293	4.191	4.082	3.535	3.301	2.947	2.875	2.818	2.618
	1000-hour season									
Plant equipment	3.046	2.014	1.818	1.609	1.398	1.417	1.286	1.232	1.285	1.207
Building	.683	.434	.343	.296	.267	.255	.241	.233	.226	.218
Shop equipment	.055	.028	.018	.014	.011	.009	.008	.008	.006	.006
Lab equipment	.041	.020	.014	.010	.008	.007	.006	.005	.004	.004
Office equipment	.104	.052	.035	.026	.021	.017	.015	.017	.015	.013
Administrative expense	2.440	1.687	1.124	1.310	1.123	.935	.802	.807	.717	.645
Total fixed cost	6.370	4.235	3.353	3.266	2.828	2.641	2.358	2.300	2.254	2.095
	1600-hour season									
Plant equipment	1.903	1.258	1.136	1.006	.874	.886	.804	.770	.804	.755
Building	.427	.271	.215	.185	.167	.159	.151	.145	.141	.137
Shop equipment	.035	.017	.012	.009	.007	.006	.005	.004	.004	.003
Lab equipment	.026	.013	.009	.006	.005	.004	.004	.003	.003	.003
Office equipment	.065	.033	.022	.016	.013	.011	.009	.011	.009	.008
Administrative expense	1.525	1.054	.703	.819	.702	.585	.501	.504	.448	.403
Total fixed cost	3.981	2.647	2.095	2.041	1.768	1.651	1.474	1.438	1.409	1.309

TABLE XLIX (continued)

Fixed factors	Plant I	II	III	IV	V	VI	VII	VIII	IX	X
	Cents									
	1800-hour season									
Plant equipment	1.692	1.119	1.009	.894	.777	.787	.714	.684	.714	.671
Building	.379	.241	.191	.165	.148	.141	.134	.129	.125	.121
Shop equipment	.031	.015	.010	.008	.006	.005	.004	.004	.003	.003
Lab equipment	.023	.011	.008	.006	.005	.004	.003	.003	.003	.002
Office equipment	.058	.029	.019	.014	.011	.010	.008	.009	.008	.007
Adminstrative expense	1.356	.937	.625	.728	.624	.520	.445	.448	.398	.358
Total fixed cost	3.539	2.353	1.863	1.814	1.571	1.467	1.310	1.278	1.252	1.164
	2000-hour season									
Plant equipment	1.523	1.007	.909	.804	.699	.709	.643	.616	.643	.604
Building	.342	.217	.172	.148	.134	.127	.120	.116	.113	.109
Shop equipment	.028	.014	.009	.007	.006	.005	.004	.003	.003	.003
Lab equipment	.021	.010	.007	.005	.004	.003	.003	.003	.002	.002
Office equipment	.052	.026	.017	.013	.010	.009	.007	.008	.007	.007
Adminstrative expense	1.220	.843	.562	.655	.561	.467	.401	.403	.358	.323
Total fixed cost	3.185	2.117	1.676	1.633	1.414	1.321	1.179	1.150	1.113	1.047

TABLE L

FIXED COST PER POUND BY LENGTH OF SEASON IN MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING AT 75 PER CENT CAPACITY, TENNESSEE, 1965

Fixed factors	Plant I	II	III	IV	V	VI	VII	VIII	IX	X
	Cents									
800-hour season										
Plant equipment	2.538	1.678	1.515	1.341	1.165	1.181	1.072	1.027	1.071	1.006
Building	.569	.361	.286	.247	.223	.212	.201	.194	.188	.182
Shop equipment	.046	.023	.015	.012	.009	.008	.007	.006	.055	.005
Lab equipment	.034	.017	.011	.009	.007	.006	.005	.004	.004	.003
Office equipment	.087	.043	.029	.022	.017	.014	.012	.014	.012	.011
Adminstrative expense	2.033	1.046	.937	1.092	.936	.779	.668	.672	.597	.538
Total fixed cost	5.308	3.539	2.794	2.721	2.357	2.201	1.965	1.917	1.878	1.745
1000-hour season										
Plant equipment	2.031	1.342	1.212	1.073	.932	.945	.857	.821	.857	.805
Building	.455	.289	.229	.197	.178	.169	.161	.155	.150	.146
Shop equipment	.037	.018	.012	.009	.007	.006	.005	.005	.004	.004
Lab equipment	.027	.014	.009	.007	.005	.005	.004	.003	.003	.003
Office equipment	.069	.035	.023	.017	.014	.011	.010	.011	.010	.009
Administrative expense	1.627	1.124	.750	.873	.748	.624	.535	.538	.478	.430
Total fixed cost	4.246	2.823	2.235	2.177	1.886	1.761	1.572	1.533	1.503	1.396
1600-hour season										
Plant equipment	1.269	.839	.757	.670	.582	.590	.536	.513	.536	.503
Building	.285	.181	.143	.123	.111	.106	.100	.097	.094	.091
Shop equipment	.023	.012	.008	.006	.005	.004	.003	.003	.003	.002
Lab equipment	.017	.009	.006	.004	.003	.003	.002	.002	.002	.002
Office equipment	.043	.022	.014	.011	.009	.007	.006	.007	.006	.006
Administrative expense	1.017	.703	.468	.546	.467	.390	.334	.336	.299	.269
Total fixed cost	2.654	1.764	1.397	1.361	1.178	1.100	.982	.958	.939	.873

TABLE L (continued)

Fixed factors	Plant I	II	III	IV	V	VI	VII	VIII	IX	X
	Cents									
					1800-hour season					
Plant equipment	1.128	.746	.673	.596	.518	.525	.476	.456	.476	.447
Building	.253	.161	.127	.110	.099	.094	.089	.086	.083	.081
Shop equipment	.021	.010	.007	.005	.004	.003	.003	.003	.002	.002
Lab equipment	.015	.008	.005	.004	.003	.003	.002	.002	.002	.002
Office equipment	.039	.019	.013	.010	.008	.006	.005	.006	.005	.005
Administrative expense	.904	.625	.416	.485	.416	.346	.297	.299	.265	.239
Total fixed cost	2.359	1.568	1.242	1.209	1.048	.978	.873	.852	.835	.776
					2000-hour season					
Plant equipment	1.015	.671	.606	.536	.466	.472	.429	.411	.428	.402
Building	.228	.145	.114	.099	.089	.085	.080	.077	.075	.073
Shop equipment	.018	.009	.006	.005	.044	.003	.003	.002	.002	.002
Lab equipment	.014	.007	.005	.003	.003	.002	.002	.002	.002	.001
Office equipment	.035	.017	.011	.009	.007	.006	.005	.006	.005	.004
Administrative expense	.813	.562	.375	.437	.374	.312	.267	.269	.239	.215
Total fixed cost	2.123	1.412	1.118	1.089	.943	.880	.786	.767	.751	.698

TABLE LI

FIXED COST PER POUND BY LENGTH OF SEASON IN MODEL PLANTS PROCESSING SNAP BEANS FOR FREEZING AT 100 PER CENT CAPACITY, TENNESSEE, 1965

Fixed factors	Plant I	II	III	IV	V	VI	VII	VIII	IX	X
	Cents									
	800-hour season									
Plant equipment	1.903	1.258	1.136	1.006	.874	.886	.804	.770	.804	.754
Building	.427	.271	.215	.185	.167	.159	.151	.145	.141	.137
Shop equipment	.035	.017	.012	.009	.007	.006	.005	.004	.004	.003
Lab equipment	.026	.013	.009	.006	.005	.004	.004	.003	.003	.003
Office equipment	.065	.033	.022	.016	.013	.011	.009	.011	.009	.008
Administrative expense	1.525	1.054	.703	.819	.702	.585	.501	.504	.448	.403
Total fixed cost	3.981	2.647	2.095	2.041	1.768	1.651	1.474	1.438	1.409	1.309
	1000-hour season									
Plant equipment	1.523	1.007	.909	.804	.699	.709	.643	.616	.643	.604
Building	.342	.217	.172	.148	.134	.127	.120	.116	.113	.109
Shop equipment	.028	.014	.009	.007	.006	.005	.004	.003	.003	.003
Lab equipment	.020	.010	.007	.005	.004	.003	.003	.003	.002	.002
Office equipment	.052	.026	.017	.013	.010	.009	.007	.008	.007	.007
Administrative expense	1.200	.843	.562	.655	.561	.468	.401	.403	.358	.323
Total fixed cost	3.185	2.117	1.676	1.633	1.414	1.321	1.179	1.150	1.127	1.047
	1600-hour season									
Plant equipment	.952	.629	.568	.503	.437	.443	.402	.385	.402	.377
Building	.213	.136	.107	.092	.083	.079	.075	.073	.071	.068
Shop equipment	.017	.009	.006	.004	.003	.003	.002	.002	.002	.002
Lab equipment	.013	.006	.004	.003	.002	.002	.002	.001	.001	.001
Office equipment	.032	.016	.011	.008	.006	.005	.005	.005	.005	.004
Administrative expense	.762	.527	.351	.409	.351	.292	.251	.252	.224	.202
Total fixed cost	1.991	1.323	1.048	1.021	.884	.825	.737	.719	.704	.655

TABLE LI (continued)

Fixed factors	Plant I	II	III	IV	V	VI	VII	VIII	IX	X
	Cents									
	1800-hour season									
Plant equipment	.846	.559	.505	.447	.388	.393	.357	.342	.357	.335
Building	.190	.121	.095	.082	.074	.071	.067	.065	.063	.061
Shop equipment	.015	.008	.005	.004	.003	.003	.002	.002	.002	.001
Lab equipment	.011	.006	.004	.003	.002	.002	.002	.001	.001	.001
Office equipment	.029	.014	.010	.007	.006	.005	.004	.005	.004	.004
Administrative expense	.678	.468	.312	.364	.312	.259	.222	.224	.199	.179
Total fixed cost	1.769	1.176	.931	.907	.786	.734	.655	.639	.626	.582
	2000-hour season									
Plant equipment	.761	.503	.454	.402	.349	.354	.321	.308	.321	.302
Building	.171	.108	.086	.074	.067	.064	.060	.058	.056	.055
Shop equipment	.014	.007	.005	.003	.003	.002	.002	.002	.001	.001
Lab equipment	.010	.005	.003	.002	.002	.002	.001	.001	.001	.001
Office equipment	.026	.013	.009	.006	.005	.004	.004	.004	.004	.003
Administrative expense	.610	.422	.281	.327	.281	.233	.200	.202	.179	.161
Total fixed cost	1.592	1.059	.838	.816	.707	.660	.589	.575	.564	.523

APPENDIX B

SUMMARY OF LABOR PRODUCTION STANDARDS FOR JOBS PERFORMED

IN PROCESSING SNAP BEANS FOR FREEZING,

TENNESSEE, 1963

Operating stage, job classification and description	Production Standard (units per hour)
Fill pallet boxes: Pallet box is filled by conveyor from washers. One man levels beans in box and operates hydrocooler conveyor.	12,954 pounds
Hydrocooling: Four pallets are in the hydrocooler simultaneously.	14,092 pounds
Inspection: Five women inspect beans on two belts and remove trash and other foreign objects. Rate varies with per cent of sort out.	15,429 pounds
Operate forklift: Empty pallet box is moved from temporary storage and set on hydrocool conveyor. Distance 300 feet.	29,322 pounds
Operate forklift: Empty pallet box is moved from conveyor at end of mechanical bin dump and set on hydrocool conveyor. Distance 200 feet.	29,322 pounds
Operate forklift: Full pallet box is removed from hydrocool conveyor and placed directly on mechanical bin dump conveyor. Distance 40 feet.	46,423 pounds
Operate forklift: Empty pallet box is transferred from mechanical bin dump conveyor to temporary storage.	22,282 pounds
Mechanical bin dump: The timing is controlled by a manually operated switch.	8,437 pounds

Operating stage, job classification and description	Production Standard (units per hour)
Carton former (9 ox.): Speeds can be varied as needed within a specified range	5,455 cartons (3068 pounds)
Operate forklift: Skid of full trays is taken from tray-off station and transferred to tunnel. Operator returns with total distance traveled 510 feet.	
A. From retail line	9,464 pounds
B. From institutional line	11,830 pounds
Operate hand truck: A skid containing 25 trays (12-2½ lb. cartons/tray) is transferred to shortage from tray-off station and operator returns to tray-off station.	2,468 pounds
Operate hand truck: A skid is moved from tray-off station to tunnel and then returns to the tray-off station with a skid of empty trays. Distance 330 feet.	15,098 pounds
Tray-off: Two men handle and fill trays.	
A. 8 ounce cartons (25/tray)	500 trays (6,250 pounds)
B. 9 ounce cartons (25/tray)	480 trays (6,750 pounds)
C. 2½ pound cartons (10/tray)	95 trays (2,375 pounds)
POLYBAG	
Filling: Polybags are filled manually on the 20 ounce polybag. The number of workers may be varied.	194 polybags/ worker (243 pounds)
Filling, weighing: Polybags (20 ounce) are filled, weighed and top of polybag folded down for mechanical sealer before being placed on conveyor.	111 polybags/ worker (139 pounds)

Operating stage, job classification and description	Production Standard (units per hour)
Weigh and adjust weight: Weight of 20 ounce polybags is checked manually.	250 polybags/ worker (313 pounds)
Installing dividers in case: Before polybags are cased, three dividers are placed in each case.	6,923 pounds
Casing: One worker cases with each case containing 12-20 ounce polybags.	143 cases 2,143 pounds
CASING	
Form and staple cases:	
Form cases	750 cases
Staple cases	857 cases
Stencil cases	600 cases
	932 cases
Casing (8 ounce): Worker forms box, takes full tray from skid and places on casing table, and places cartons in box. The number of workers may vary.	120 cases/ worker
Casing (10 ounce): Three women fill each case on Conveyor with each case containing 24 10-ounce cartons.	500 cases 7,500 pounds
Moving full trays from skid to casing table:	545 trays (16,364 pounds)
Remove empty trays from casing table and stack on skid:	545 trays (16,364 pounds)
Closing case and stacking:	222 cases
Mechanical closing of case:	667 cases

Operating stage, job classification and description	Production standard (units per hour)
Closing manually by interlocking lids: Wrapping sealed cases with tape: Number of workers varies:	667 cases 154 cases/ worker
Operate forklift: Loaded skid is taken to cold storage and operator returns to casing station for another skid. One skid contains 78 cases of 24 9-ounce carton per case, or 48 cases of 12 2½-pound cartons per case.	
A. If carrying retail cartons	9.251 pounds
B. If carrying institutional cartons	12,773 pounds
Operate forklift: Skid of empty trays moved from casing station to tray-off station and operator returns. Distance traveled 170 feet.	
A. If carrying to retail line	41,167 pounds
B. If carrying to institutional line	56,837 pounds
Operate forklift: Loaded skid is moved from tray-off station to tunnel and a skid in the tunnel is moved to temporary cold storage. Distance 300-500 feet.	
A. If carrying retail cartons	12,799 pounds
B. If carrying institutional cartons	15,998 pounds
Operate forklift: Loaded skid is moved to tunnel and a loaded skid is brought to casing station. Distance 300-500 feet.	
A. If carrying retail cartons	9,337 pounds
B. If carrying institutional cartons	11,671 pounds
PACKAGING BULK	
Attend tray fill: Two men handle the racks.	1,782 pounds
IQF fill: Bags are placed under bulk filler and filled.	429 bags 25,740 pounds
Serving bags and placing on conveyor:	333 bags 19,980 pounds

APPENDIX C

UTILITIES' RATES

Knoxville Utilities Board - Electricity rates for commercial use.

Rate C - Customer's demand for the month or contract demand is greater than 5,000 kilowatts.

The demand for any month shall be the highest average load measured in kilowatts during any 30 consecutive minute period of the month.

Demand charge: $1.00 per month per kilowatt of billing demand within the customer's contract demand.

Energy charge: $ .00275 per kilowatt hour.

Knoxville Utilities Board - Water rates for commercial use.

Schedule E - Contract rate for large industrial, commercial or other uses.

The demand shall be the greatest quantity of water used in any day during the month under consideration, subject to the provision that the demand shall not be less than the greatest quantity of water used in any day in the 12 month period ending with the month under consideration.

Demand charge: First 75,000 cubic feet or less of demand per month, $375.00. Excess over 75,000 cubic feet of demand per month at 50 cents per 100 cubic feet.

Commodity charge: All water per month at 5.6 cents per 100 cubic feet.

Knoxville Utilities Board - Gas rates for commercial use.

Rate G - 5 - Demand may be estimated as 5 per cent of the total quantity of gas used during the month.

Demand charge: First 5 therms or less of demand per month $6.25.
Excess over 5 therms of demand per month at 75 cents per therm.

Commodity charge: First 500 therms per month at 9.5 cents per therm.
Next 3,000 therms per month at 5.2 cents per therm.
Next 6,500 therms per month at 4.5 cents per therm.
Excess over 10,000 therms per month at 4.2 cents per therm.