# Cost Comparisons of Grocery Departments in Conventional Supermarkets and Super Stores with Implications for Training

by
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The purpose of this paper is to examine impacts of selected changes in organization and technology applicable to grocery stores and their implications for management and training of store operations personnel. This is one of several research projects being conducted by the Economic Research Service (ERS) to identify and evaluate possible sources of increased productivity in the food distribution system.

Cost comparisons were made among grocery departments in three types of supermarkets: 1) a typical conventional supermarket, 2) an optimum conventional supermarket, and 3) a super store. In this paper super store refers specifically to a supermarket that receives and displays high volume grocery items in bins and handles at least 11,000 cubic feet of dry groceries per week. In this presentation this type of store will be called super store with bins.

Production functions used to estimate costs of direct labor, floor space, and display equipment for the three types of stores were based on economic engineering standards.[1] Costs for the conventional and optimum conventional stores were determined at sales volumes ranging from 3,000 to 40,000 cubic feet per week of dry groceries. Volume levels for the super store with bins were from 11,000 to 40,000 cubic feet per week. Although we are not aware of any stores in the U.S. that handle 40,000 cubic feet of dry groceries per week, costs were estimated at this level for all three types of stores to gauge the relative potential efficiency of such large stores. Such stores are now in Europe and may appear in the U.S.

## Typical Conventional Store

Groceries were assumed to be unloaded by conveyor into the stores' backrooms. Later, cases are placed on a conveyor and opened for price marking. After price marking, cases are sorted by aisle and placed on carts for stocking during store hours. Cardboard waste is removed to the backroom and baled. About 25 percent of the total dry grocery volume is assumed to be stocked by vendors.

Shelf space allocation was determined in a typical manner based on store personnel estimates of the amount of space needed for each item. This usually results in an allocation greater than the minimum space needed to adequately merchandise products and avoid "outs." The typical store handled 7,100 dry grocery items when total movement exceeded 10,000 cubic feet per week. The number of items was lower at lower volumes.

## Optimum Conventional Store

The optimum conventional supermarket has six innovations not found in the conventional supermarket:

1. Most products are received on pallets and moved directly to aisles.

2. To minimize labor costs, most items are displayed in tray packs.

3. Labor scheduling is based on analytical forecasts of daily manhour requirements.

4. Maximum use is made of after hours stocking.

5. Stocking travel distances are minimized by assuming an optimum store layout. (The back room is centered and the sales area has an optimum length to width ratio.)

6. Shelf space is allocated based on computer analyses of projected item movement and merchandising requirements.

## Super Store with Bins

The super store with bins model has the six innovations included in the optimum conventional store. In addition, high volume items are received and stocked in bins. Vendor delivered items are handled in the conventional manner. Centrally warehoused and delivered items are handled and displayed in a manner that minimizes total labor and fixed costs. Three methods of handling and display are considered: 23 cubic foot capacity bins (or wire baskets); 7 cubic foot capacity bins; and tray packs. Full bins are moved to the sales floor in stacks of 2 or 3 using a fork lift and are placed individually in reserve storage above the display racks. They are lowered to the display racks as needed. The 23 cubic foot bins are displayed 2 tiers high with 2 reserve tiers above, whereas the 7 cubic foot bins have 3 display and 3 reserve tiers. The front of the bins fold down to allow customer selection.

The super store with bins model assumed that bins are filled and prepriced by the food processor (a practice not currently found in the U.S.) or at the retailer's warehouse. Net additional costs or savings resulting from shipment of bins (and prepricing of items) rather than cases by processors was not evaluated. If UPC scanning equipment is used, prepricing would not be necessary for UPC source marked items, unless required to provide information to consumers.

## Cost Comparisons

The major difference between the three types of stores is direct labor requirements. However, there are also cost differences steming from variation in sales area and fixtures requirements. Conventional and optimum conventional stores were not analyzed at volumes below 3,000 cubic feet per week because there was too much variability in number and mix of items among stores. The superstore with bins was not analyzed at volume levels below 11,000 cubic feet per week because lower levels would require less than one full aisle of bins.

## Direct Labor

Direct labor needed to handle dry groceries was calculated using uniform labor standards and handling methods appropriate for each store type and a $5.00 per hour rate. Where appropriate, labor requirements and costs were calculated for receiving, case opening, price marking, sorting and moving to aisles, and shelving functions for individual item displays, single and double tray displays, single and double dump displays, and bins. Labor for handling vendor stocked items was not included as a store cost. Except in the conventional store with typical practices, the least expensive method of shelf stocking was used whenever practical. Optimum labor scheduling and after hours

stocking in the optimum conventional and super stores reduced labor requirements below that of conventional store by 7.8 percent.

Estimates of direct labor costs are shown in Figure 1 for each store type at different volume levels. The conventional store is relatively inefficient in the use of direct labor. Labor costs per unit in optimum conventional store are 50 percent lower than conventional stores at all volume levels (Table 1). The super stores with bins have lower costs than optimum conventional stores, but the differences are less. The greatest advantage of the super store with bins is realized in very high volume levels.

Table 1. Index of Direct Labor Costs per Cubic Foot of Dry Grocery Volume per Week by Store Type and Size.[1]

| Store Type | Cost Index per Cubic Foot Volume per Week (Cubic Feet) (Conventional Store at 3,000 Cubic Feet per Week = 100) | | |
| --- | --- | --- | --- |
| | 3,000 | 11,000 | 40,000 |
| Conventional | 100 | 100 | 100 |
| Optimum Conventional | 50 | 50 | 50 |
| Super Store With Bins | NA | 45 | 35 |

[1]Excluding vendor and checkout labor.

## Sales Area and Fixtures

Lower labor costs were achieved by investments in building and equipment. Costs of floor space and display equipment were estimated based on handling methods used by each store type.

Floor space included the grocery sales area only, and excluded checkout and courtesy booth. Equipment and building costs were annualized based on estimated life expectancies and an 8 percent interest rate (cost of money) and then converted to a weekly basis for comparisons.

The optimum conventional store had higher initial building and fixtures costs than the conventional store (Figure 2). The optimum conventional store had about 34 percent higher floor and fixture costs than did conventional at 11,000 cubic feet per week and about 24 percent more at 40,000 cubic feet per week (Table 2 and Figure 3). The super store with bins had the highest costs because of the expense of bins, and racks, as well as additional floor space requirements. At 11,000 cubic feet per week, capital costs were more than 40 percent higher than the super store with bins than for the conventional.

Table 2. Index of Weekly Floor and Fixture Costs for Dry Grocery Department by Store Type and Size

| Store Type | Cost Index for Grocery Department Volume per Week (Cubic Feet) (Conventional Store at 3,000 Cubic Feet per Week = 100) | | |
| --- | --- | --- | --- |
| | 3,000 | 11,000 | 40,000 |
| Conventional | 100 | 221 | 496 |
| Optimum Conventional | 158 | 298 | 615 |
| Super Store With Bins | NA | 312 | 713 |

**DRY GROCERIES DIRECT LABOR* BY STORE TYPE**

*Vendor and Check Out Labor Excluded
Labor Rate: $5 per Hour

DOLLARS PER WEEK

CONVENTIONAL

OPTIMUM
CONVENTIONAL

SUPER STORE
WITH BINS

11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0

5,000   10,000   15,000   20,000   25,000   30,000   35,000   40,000

Dry Groceries Movements, Cubic Feet per Week

FIGURE I

**INITIAL DRY GROCERIES STORE SALES FLOOR AND
FIXTURE COST BY STORE TYPE, 1975**

DOLLARS

800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000

SUPER STORE
WITH BINS

OPTIMUM
CONVENTIONAL

CONVENTIONAL

5,000   10,000   15,000   20,000   25,000   30,000   35,000   40,000
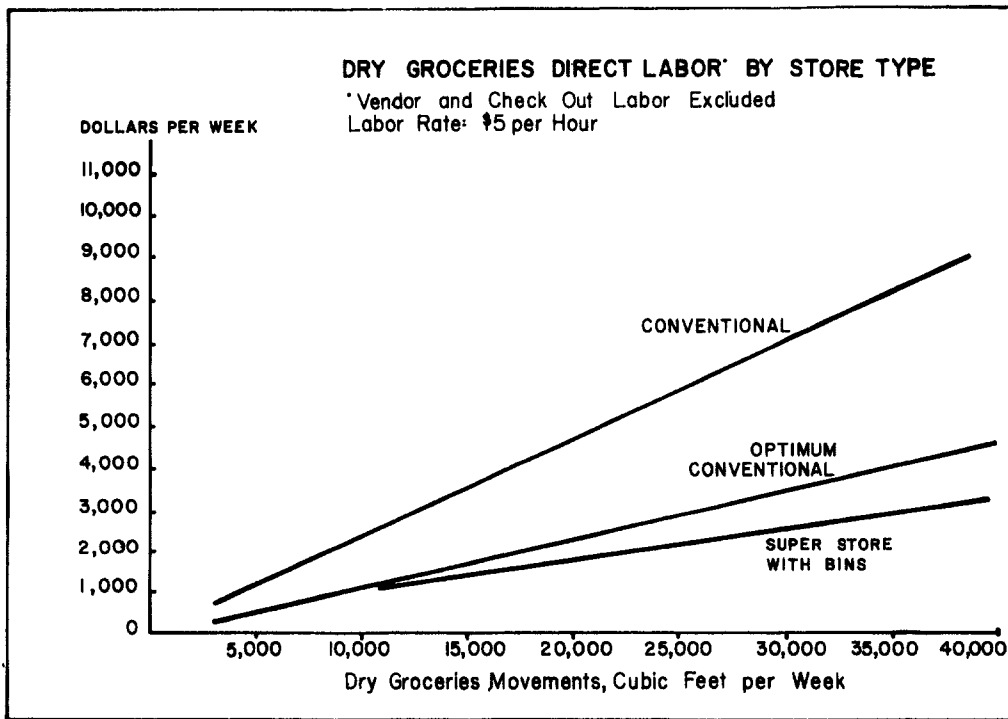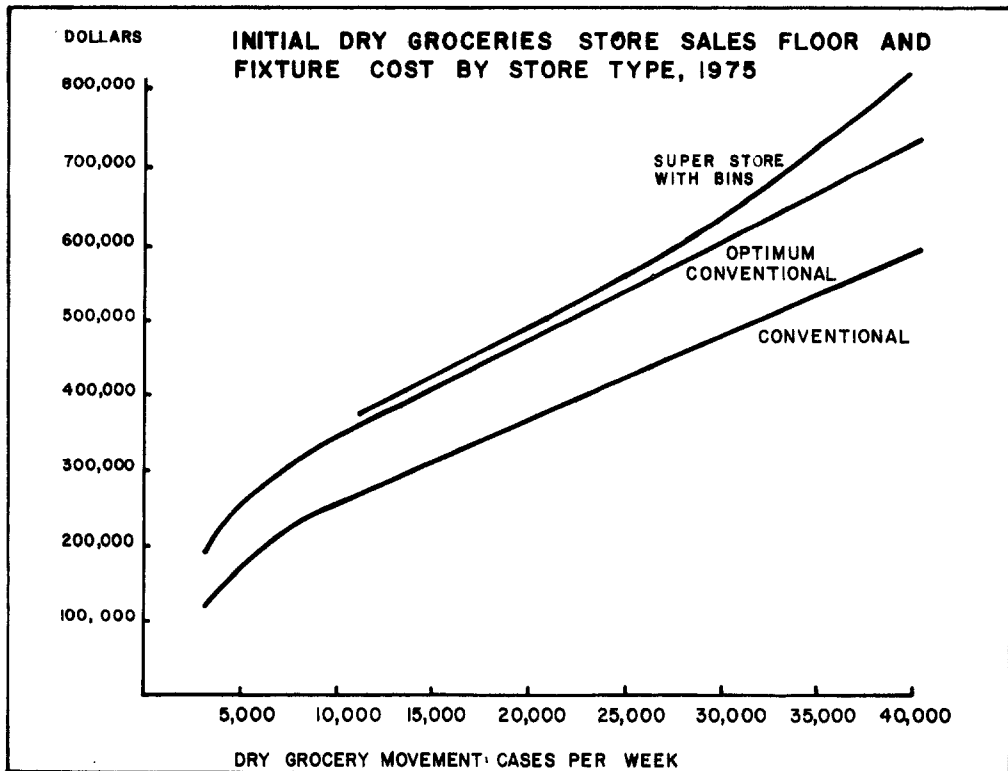
DRY GROCERY MOVEMENT: CASES PER WEEK

FIGURE 2

## Direct Labor, Floor, and Fixture Costs

To provide more comprehensive comparisons, costs for direct labor (excluding check out), floor, and fixtures were combined for each store type (Figure 4). Combined costs for the optimum conventional store were 36 and 42 percent less than for the conventional store at volume levels of 11,000 and 40,000 cubic feet per week, respectively (Table 3). Costs of the super store with bins were 40 to 51 percent less than for the conventional store with volumes at 11,000 and 40,000 cubic feet per week, respectively. The comparisons showed that large savings result from going to an optimum conventional store from the conventional. Additional savings occur from a super store with bins. However, the greatest cost advantage of the super store with bins was realized at the highest volume level.

## Economies of Size

The optimum conventional store showed greater size economies than did the conventional store. Economies of the super store with bins were even greater. When weekly volume was increased from 3,000 cubic feet (currently typical) to 11,000 cubic feet, unit costs of the conventional store declined 11 percent while unit costs of the optimum conventional declined 28 percent. When weekly volume was increased to 40,000 cubic feet, savings in unit costs were 6 and 14 percent, respectively, for conventional and optimum conventional. Unit costs of the superstore with bins fell 23 percent when volume was increased from 11,000 to 40,000 cubic feet per week.

Table 3. Index of Direct Labor, Floor, and Fixture Costs per Cubic Foot of Dry Grocery Volume per Week by Store Type and Size[1]

| Store Type | Cost Index per Cubic Foot Volume per Week (Cubic Feet) (Conventional Store at 3,000 Cubic Feet per Week = 100) | | |
|---|---|---|---|
| | 3,000 | 11,000 | 40,000 |
| Conventional | 100 | 89 | 84 |
| (difference)[2] | (21) | (32) | (35) |
| Optimum Conventional | 79 | 57 | 49 |
| (difference) | | (4) | (8) |
| Super Store With Bins | NA | 53 | 41 |

[1] Excludes vendor and check out labor.

[2] Difference in index number between store types.

## Aggregate Impacts

On purely technical grounds, there is a potential for considerable savings in grocery departments of supermarkets if innovations or conditions identified with the optimum conventional store were realized. For the industry these savings could amount to 1 to 2 percent of dry grocery sales or one-half to one billion dollars per year. In the short run, however, few supermarkets could be expected to adopt all of these innovations because new buildings and equipment are necessary and only 5 to 10 percent of supermarkets are new or remodeled each year.

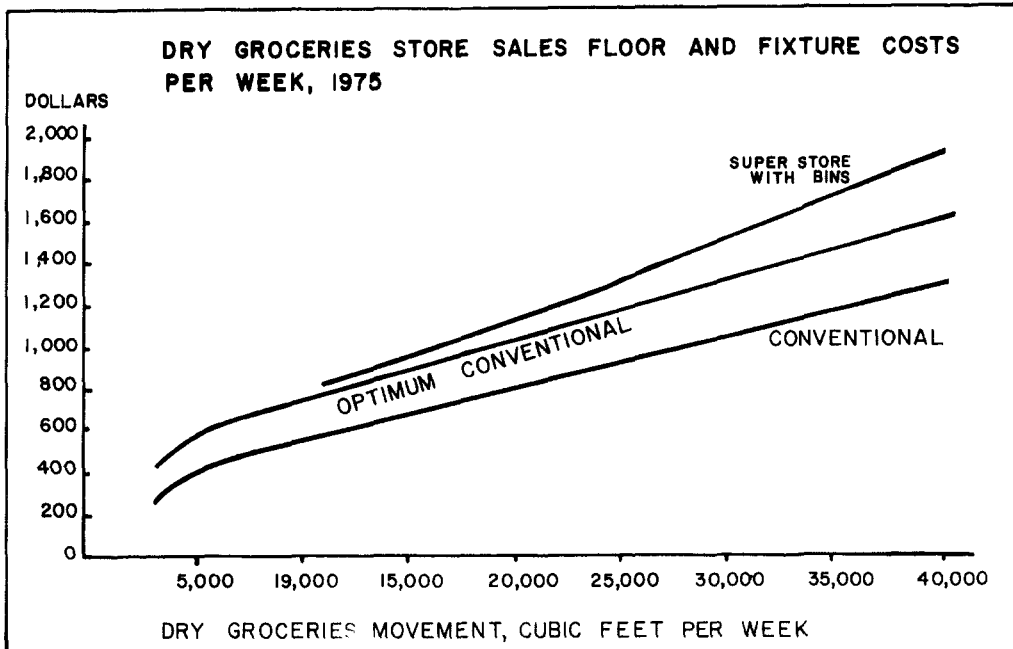The basic innovations have the effect of increasing capital-labor ratios

DRY GROCERIES STORE SALES FLOOR AND FIXTURE COSTS
PER WEEK, 1975

DOLLARS

2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0

SUPER STORE
WITH BINS

OPTIMUM CONVENTIONAL

CONVENTIONAL

5,000   19,000   15,000   20,000   25,000   30,000   35,000   40,000

DRY GROCERIES MOVEMENT, CUBIC FEET PER WEEK

FIGURE 3

DOLLARS PER WEEK    DRY GROCERIES DIRECT LABOR·, SALES AREA
                                                    AND FIXTURES

12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0

COSTS PER WEEK
`Vender and Check Cut Labor Excluded
Labor Rate: $5 per Hour

CONVENTIONAL

OPTIMUM
CONVENTIONAL

SUPER STORE
WITH BINS

5,000   10,000   15,000   20,000   25,000   30,000   35,000   40,000
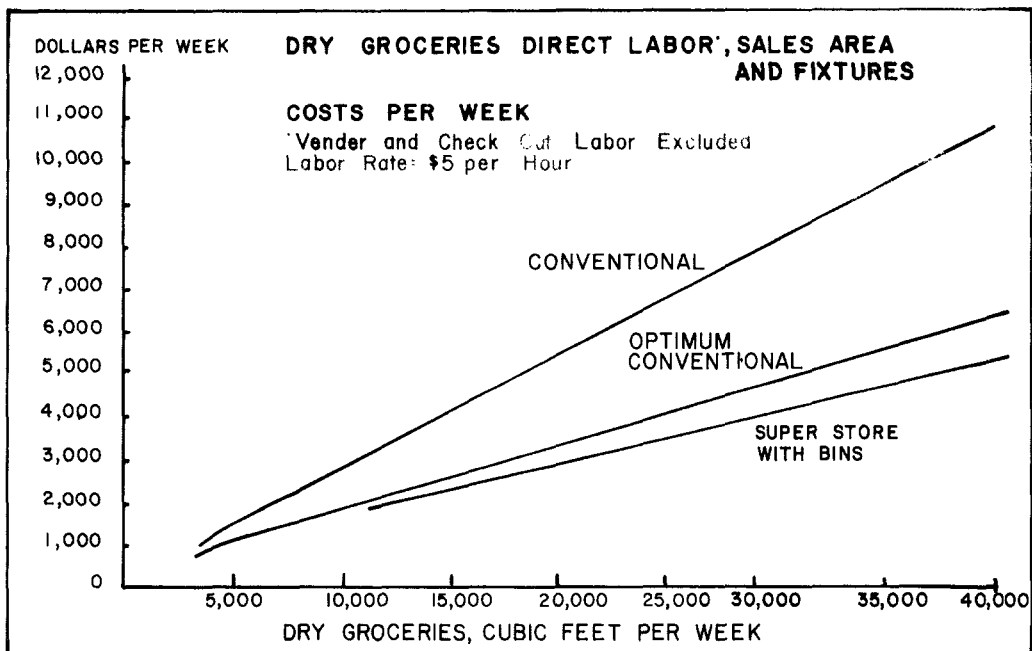
DRY GROCERIES, CUBIC FEET PER WEEK

FIGURE 4

and they place a very high premium on maintaining and increasing store volume. However, the innovations relating to labor scheduling and shelf space allocation offer opportunities for short run cost savings because additional space or equipment are not necessary.

Possibly super stores with bins could achieve savings 10 to 20 percent greater than those of the optimum conventional store. However, a super store with bins requires a substantial capital investment and needs a very large population base. A typical (3,000 cubic feet per week) conventional store needs some 5,000 customer equivalents[2] per store; a 11,000 cubic feet per week store requires 16,000 customer equivalents; and a 40,000 cubic feet per week store requires 65,000 customer equivalents. Moreover, since a large super store will be competing with other stores, the market area would require a population considerably larger than 65,000 to support it. Therefore, we can expect the impact of large super stores to be limited to the larger metropolitan areas.

### Implications for Training

To help realize potentials for increased efficiency possible from optimum conventional and super stores, firms' management and store employees must be motivated and well trained. Success depends on a well organized operation. It is important that management be familiar with new concepts and principles.

#### Management

Training is particularly important for managerial personnel with respect to labor scheduling and shelf space allocation programs. Store level personnel should be involved in obtaining and analyzing information used in the labor scheduling program. Feedback from stores is necessary to assess the effectiveness of new labor scheduling programs. Labor representatives should be consulted throughout the planning and implementation stages.

The successful implementation of the space allocation program also requires effective management training. If shelf allocation analyses and resulting recommendations are handled centrally, it is still necessary to provide training for the store manager so that he will understand and have confidence in the system and provide feedback needed to update, evaluate and verify shelf allocation.

The super store with bins will affect merchandising and promotional practices because grouping and location of products will be based more on volume movement characteristics rather than traditional product groupings. This may necessitate special training programs in merchandising and promotions.

#### Employees

Operation of optimum conventional and super stores with bins requires more organized and formal work patterns than are typical in most supermarkets. For this reason it is critical that all employees be highly motivated and trained for their assigned tasks. Work rules and sanctions need to be explicit, understood, and followed. Management should plan to work with labor officials and use the labor organization to help achieve adherence to the specified work rules.

The super store with bins has some special implications for training. The use of bins and fork lifts in the sales area makes it necessary to train fork lift operators to work in the store. This training should include consideration for the safety of store personnel and customers.

Finally, because success of op-
timum conventional and super stores
with bins is dependent on high sales
per store, all employees must be
trained to deal courteously with people
and provide an atmosphere that en-
courages customers to continue their
patronage. Employment practices, work
rules and sanctions should also strongly
support this effort.

Footnotes

[1] Findings are derived from Case and Co.
report to USDA, "Study of Cost Savings
of Major Innovations in Dry Grocery
Handling at Supermarkets," April 1975.
The analysis uses economic engineering
techniques. Further information requests
as to methods and assumptions should be
directed to the authors.

[2] A customer equivalent equals one exclu-
sive customer (shops only at one store)
or the number of nonexclusive customers
needed to purchase the same amount of
goods as purchased by an exclusive cus-
tomer.

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# SANITATION PROCEDURES, COSTS, AND MANAGEMENT PRACTICES
## OF FOUR OREGON RETAIL FOOD STORES

by
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This abstract highlights the find-
ings of a study conducted under a
cooperative research agreement between
the Department of Agricultural and
Resource Economics, Oregon State Uni-
versity and the Agricultural Research
Service, USDA (1973-1976). Formal pub-
lication of the study's findings is
expected within three to six months.

The purpose of this study was to
develop more information on procedures,
costs and management practices of sanita-
tion programs in supermarkets. The
specific objectives were to: (1) Identify
and evaluate current procedures and pro-
blems associated with cleaning and sani-
tizing all areas of retail food stores;
(2) develop comparative labor, service,
equipment, and supply cost data for
existing sanitation procedures in retail
food stores; (3) identify and analyze
current retail food store sanitation
management practices; and (4) develop
recommendations for improving sanitation
procedures and management practices, and
for controlling sanitation program costs
in retail food stores.