# THE POTENTIAL FOR OFFICE AUTOMATION IN DEPARTMENT STORES*†

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Potential for office automation in department stores is explored by sales volume class. This is done in terms of the present-day expenses in the clerical work area and the inventory management area typical of the stores in each volume class. Some characteristics of the "typical" stores are also briefly reviewed. The data used are those given in the Harvard Business School Survey conducted in 1963 [1].

## 1. Introduction and Summary

The advent of modern electronic computing devices has brought forth automation of office paperwork in many industries. The department store industry has not been an exception, although, compared to other industries, it is only recently experiencing the impact. It is of interest at this time, therefore, to explore the potential for office automation in the department store business. This paper presents some results of a limited study of this problem at the level of the firm. The source of data is the latest Harvard volume on department store operating results [1].

In what follows, first the subjects of inquiry, namely, the department stores, are defined, by briefly reviewing some of their characteristics. Next, the potential for office automation in these stores is examined, by considering present-day expenses incurred in (a) the clerical work area, and (b) the inventory management area as appropriate measures. Finally, the results obtained and the data used are briefly discussed.

## 2. Some Characteristics of Typical Department Stores

The number of department stores in business in the United States appears to be rather large.[1] In order to characterize the subjects of inquiry, therefore, it would be desirable to segment the population of department stores by some appropriate criterion, and then to characterize the segments.

Unfortunately, published data on segments of the department store business

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† The views expressed in this paper are strictly those of the author: in no way do they reflect those of his employer, The National Cash Register Company.

[1] The 1958 Census of Business showed a *population* total of about 3200 establishments (Reference 2). Of course, as is well known, the Bureau of Census defines a department store in a broad sense. (For a discussion of the definitions see, for example, p. 11 of the recent book by M. P. McNair and E. May (Reference 3)).

The Bureau of Research of the Harvard Business School adopts a more restricted definition for their annual survey of department store operating results. Still, in their 1963 survey it was indicated that their *sample* consisted of 299 firms operating 712 establishments (Reference 1). A few of these were Canadian stores.

are limited. Two annual publications are well-known. One is The Harvard Business School publication [1] and the other is the National Retail Merchants' Association publication [4]. Both publications use annual sales volume of a firm as the criterion for segmentation. Both present the operating results of the segments, mostly of financial and accounting nature. The Harvard publication gives more details on expense centers[2] and the NRMA publication, more on merchandising departments.[3]

The study described here makes use of the data in the Harvard publication. This resulted in the adoption of both Harvard's definition of the department store and their criterion of segmenting the department store population by annual sales volume.[4]

In this part of the paper, three groups of statistics characterizing the typical store in each sales volume class are briefly reviewed.[5] The main purpose of this review is to specify precisely the subjects of inquiry, viz., the segments of the department store population. In the interest of brevity, just enough calculated data are shown to accomplish this. Many other statistics, though perhaps more helpful, are more readily available in reference 1; they are hence merely cited here.

## 2.1 Capacity Based upon Observable Physical Resources

It is helpful to have some idea of the observable physical characteristics of a business concern before discussing its other characteristics. Exhibit 1 shows, after several useful sales figures, four such statistics typical of the department stores in each sales volume class. These are: floor space, number of employees, hours open, and number of stores. All four statistics give some indication of the degree to which firms in a given volume class have typically committed their physical resources to be in business. That is, all of these give some measure of the "capacity" of the typical store.[6] The methods of calculation for these statistics are described in Section 2.1.1.

It may be seen that a simple relationship appears to exist between two of the statistics shown and the typical sales figures of the classes. That is, among classes, both the number of employees and total floor space appear to increase approximately linearly with sales.

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[2] For definitions of expense centers see Reference 5.
[3] For definitions of merchandising departments see Reference 6.
[4] It should be noted that the "firm" (or the "company"), rather than the individual establishments (or the "stores"), is the primary sampling unit in the Harvard study. The word "store" is generally used to refer to the "firm" there. This is also the way the word "store" is used here. Exceptions should be self-evident.
[5] The word "typical" is used in the sense defined by Professor M. P. McNair in reference 1. The "typical" value of a measurable characteristic of a given volume class is the inter-quartile average of all values of that characteristic in the sample. (See p. 167 of reference 1.) A typical department store is thus a non-existent statistical entity.
[6] The word "capacity" is used here because it conveniently groups the four characteristics mentioned. No definition of capacity in the economic sense is intended.

| Description | Volume Class in Millions of Dollars | | | | | |
|---|---|---|---|---|---|---|
| | 1–2 | 2–5 | 5–10 | 10–20 | 20–50 | Over 50 |
| Gross Sales (Million $) | 1.55 | 3.40 | 7.66 | 14.3 | 31.8 | 87.0 |
| Net Sales (Million $) | 1.5 | 3.2 | 7.2 | 13.4 | 29.2 | 79.3 |
| Net Sales in Owned Departments (Million $) | 1.39 | 2.92 | 6.69 | 12.2 | 27.2 | 75.2 |
| Average Main Store Gross Sales (Million $) | | | | 12.7 | 20.2 | 45.7 |
| Average Gross Sales/Branch (Million $) | | | | .454 | 3.08 | 8.64 |
| Total Space (Thous Sq Ft) | 42.3 | 96.5 | 202 | 412 | 866 | 1,975 |
| Total Selling Space (Thous Sq Ft) | 27.8 | 58.8 | 120 | 207 | 457 | 967 |
| Total Number of Employees | 92 | 201 | 421 | 714 | 1,590 | 3,704 |
| Total Number of Sales People | 56 | 110 | 229 | 366 | 785 | 1,741 |
| Average Number of Stores per Firm | 2.06 | 1.21 | 1.69 | 3.10 | 4.43 | 5.78 |
| Total Number of Hours Open per Week | | | | | | |
| Main Store | 50.18 | 51.23 | 53.60 | 55.05 | 54.72 | 54.37 |
| Branch Store | 51.30 | 51.50 | 58.00 | 59.58 | 59.28 | 61.38 |

*Exhibit 1. Capacity of U. S. Department Stores by Sales Volume, Based upon Observable Physical Resources, 1962*

Source of Data: "Operating Results of Department and Specialty Stores in 1962," M. P. McNair, Harvard Business School

### 2.1.1 *Methods of Calculation*

Of the four statistics shown, two may be readily obtained from the data given in reference 1; these are the average number of stores per firm and the hours open. The other two statistics may be calculated by several alternative methods using the data given. For example, two of the methods of calculating the selling floor space are as follows:

(a) gross sales divided by sales per square foot of selling space, and

(b) total space multiplied by the ratio of selling space to total floor space.

Generally, however, alternative methods of calculation yield answers that do not agree. The methods used here are all based on gross sales. Whether or not this is a more accurate method than others is difficult to judge; but it does have the advantage of computational simplicity. The methods of calculation are as follows:

(a) Gross Sales — (Net Sales)/(1 — Returns and Allowances)

(b) Net Sales in Owned Departments $=\left[\begin{pmatrix}\text{\% Sales in} \\ \text{Owned} \\ \text{Departments}\end{pmatrix} - \begin{pmatrix}\text{\% Returns} \\ \text{in Owned} \\ \text{Departments}\end{pmatrix}\right] \times \begin{pmatrix}\text{Total Gross} \\ \text{Sales in} \\ \text{Owned Dept}\end{pmatrix}$

(c) Gross Sales/Branch store[7] $=\left[\begin{pmatrix}\text{Total} \\ \text{Gross} \\ \text{Sales}\end{pmatrix}\begin{pmatrix}\text{Branch} \\ \text{Sales to} \\ \text{Total \%}\end{pmatrix}\begin{pmatrix}\text{\# of Firms} \\ \text{with Branch} \\ \text{Stores}\end{pmatrix}\right]$

$\div \left[\begin{pmatrix}\text{Total \# of} \\ \text{Stores} \\ \text{Covered}\end{pmatrix} - \begin{pmatrix}\text{Total \# of} \\ \text{Firms} \\ \text{Reporting}\end{pmatrix}\right]$

(d) Total Space = (Gross Sales)/(Sales per Square Foot Total Space)

(e) Total Selling Space = (Gross Sales)/(Sales per Square Foot Selling Space)

(f) Total Number of Employees = (Gross Sales)/(Sales per Employee)

(g) Total Number of Sales Employees = (Gross Sales)/(Sales per Sales Employee)

## 2.2 *Utilization of Physical Resources Based upon Sales*

Gross annual sales are usually used to indicate the accomplishments of a business concern. When gross sales are related to measures of the concern's physical resources such as floor space, some simple gross measures of the utilization of the store's resources are obtained. For example, sales per square foot of space, sales per employee, and sales per transaction are all such measures.

A few simple breakdowns of gross sales could also be viewed, in a broad sense, as reflections of the utilization of some of the concern's facilities. For example, percentage of total sales achieved by the owned departments of the store, that achieved by the main store, and that by credit sales, are measures of this kind.

Again, both such kinds of statistics may be found in reference 1.

## 2.3 *Performance Based on Accounting Data*

Standard measures of performance of a business concern are generally based upon accounting data. Two groups of such measures given in reference 1 are of particular interest here. These are: (a) Financial Ratios and (b) Controllable Margin and Variable Expenses.[8]

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[7] Calculations of the sales breakdowns between the "main" and "branch" stores make use of the information about the number of branch stores given on p. 27 of reference 1.

[8] Reference to this source will show that in all volume classes the three highest variable expenses are incurred by the following expense centers in the order listed: Direct Selling, Advertising, and Accounts Receivable and Credit. This clearly suggests that a department store could look into at least three areas to improve its profit picture. These are: its sales force, or method of selling; its use of advertising; and its accounts receivable operation. The last area leads naturally to a consideration of office automation, assuming of course that credit sales must be maintained by the store.

# 3. Potential for Office Automation

In the short history of commercial electronic data processing, the areas in which users of computer systems have found justification for office automation are generally the following two: clerical work and inventory management.[9] These areas appear to be major problem areas in the department store business also.

Clerical work in a department store certainly is a problem area in which office automation deserves consideration. This point has already been raised previously when the accounts receivable and credit operations expenses were examined. Of course, accounts receivable and credit operations constitute only part of the total clerical work in a department store. Others such as sales analysis, payroll and accounts payable may also stand to benefit from office automation.

Inventory management or merchandise control appears to be another major area in which office automation holds some promise for the department store. Unfortunately, the accounting practice generally in use in the department store business today does not produce information that is useful for inventory decisions. It is thus very difficult, if not impossible, to produce an adequate cost picture regarding the inventory management function. Nevertheless, the large variety of merchandise handled by a department store and the constant concern of store management with the movement of merchandise in the store suggest that the potential benefits of office automation in the merchandise control area warrant some exploration here.

Clearly, without data on such things as systems and procedures, activity levels, reports, etc., it is not possible to present a detailed picture of the data-processing situation. However, using the data given in the Harvard publication, it is possible to examine the situation partially in *gross* terms. Accounting data given there follow the NRMA Expense Center Manual [5] which is widely adopted in the department store business. From such data, variable expenses may be obtained by expense centers, or roughly, by functional areas. It seems reasonable to use the actual expenses resulting from present-day office practices in a functional area as a *rough* measure of the potential for office automation in that area. This is the approach adopted in this study.

In this part of the paper the potential for office automation in the clerical work area and in the merchandise inventory management area of department stores typical of each volume class are examined separately. The expenses considered include the actual present-day expenses of processing the paperwork (e.g., clerical wages) and the associated expenses of present-day policy (e.g., imputed interests). The reason for including the former is self-evident; the reason for including the latter is that these expenses may, conceivably, also be altered by automation (e.g., reduced inventory will result in reduced imputed interest charges). Not

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[9] The term "office automation" is to be loosely regarded as synonymous with electronic data-processing and the associated application of management science techniques. No precise definition will be given in this paper.

considered here are present-day equipment costs or rentals, as these are impossible to calculate or estimate from the data available. More discussion of the expenses will be given later when each of the two broad areas is considered individually.

## 3.1 *Potential in Clerical Work Area*

Obtaining an indication of the potential for office automation in the clerical work area in terms of present-day expenses requires the following steps: deciding on the expense centers, deciding on the expenses in each center, and performing the calculations. These steps are described respectively in Sections 3.1.1, 3.1.2, and 3.1.3.

The results of this effort are shown in Exhibit 2. It may be seen that the total expense in dollars attributable to clerical work (i.e., the desired potential) appears to increase proportionally with the annual sales volume. That is, this total, as a percentage of net sales, appears to be approximately the same (about 2.7 %) for all volume classes.

## 3.1.1 *Expense Centers Included*

The definitions of the expense centers given in the NRMA manual [4] are examined to determine the expense centers (or roughly, the functional areas) to be included in the clerical work area. The criteria for inclusion are that the function is concerned, in part or as a whole, with paperwork; and that if so, it is likely to be affected by office automation. In terms of the NRMA's Expense Center Accounting System, included here are expense centers 200 CONTROL & ACCOUNTING, 300 ACCOUNTS RECEIVABLE & CREDIT, and 600 PERSONNEL & EMPLOYEE BENEFITS.

| Expenses | Volume Class in Millions of Dollars | | | | | |
|---|---|---|---|---|---|---|
| | 1–2 | 2–5 | 5–10 | 10–20 | 20–50 | Over 50 |
| Payroll % | 2.27 | 2.29 | 2.17 | 1.90 | 1.83 | 1.71 |
| Services Purchased % | .06 | .22 | .31 | .30 | .56 | .81 |
| Employee Benefits % | .18 | .189 | .185 | .195 | .16 | .177 |
| Employee Discounts % | .10 | .09 | .08 | .08 | .08 | .08 |
| Total Expenses Attributable to Clerical Work | | | | | | |
| % of Net Sales | 2.61 | 2.79 | 2.74 | 2.48 | 2.63 | 2.78 |
| Dollar Amount (Thous) | 36.3 | 81.5 | 183 | 302 | 715 | 2,090 |

*Exhibit 2. Total Annual Expenses Attributable to Clerical Work in U. S. Department Stores by Volume Class, 1962*

Note: Net Sales in Owned Departments = 100%
Source of Data: "Operating Results of Department and Specialty Stores in 1962", M. P. McNair, Harvard Business School

The expense centers *excluded* and the reasons for doing so are given below.

(a) Expense Center 100 FIXED & POLICY EXPENSE covers essentially the general management function. Such a function is not likely to be amenable to office automation.

(b) Expense Centers 400 SALES PROMOTION and 800 DIRECT & GENERAL SELLING constitute the selling activities. It is assumed that by definition, a department store does its business through sales clerks and advertising. Possibility of automation is thus ruled out.

(c) Expense Center 500 SUPERINTENDENCY & BUILDING OPERATIONS covers activities that are less likely to be affected by office automation. (Of course, these activities would be affected by automation in its general sense.)

(d) Expense Centers 700 MATERIAL HANDLING and 900 MERCHANDISING cover activities that are properly part of the inventory management problem area to be considered later. Also, some of the merchandising activities are related to buying, which may, as in the case of selling activities, be considered as inherent department store activities and not affected, by definition, by office automation.

### 3.1.2 *Expenses 'uded*

The NRMA manual is again consulted in deciding whether or not a given type of expense is to be included. The criterion for inclusion is that the present-day expense would be conceivably eliminated or reduced by the introduction of office automation equipment. Thus, considered to be appropriate here are (a) payroll expenses in the functional areas listed, (b) supplementary benefits to employees in the functional areas considered, (c) services purchased by the functional areas considered, and (d) cost equivalents of discounts allowed the employees in the functional areas considered.

Not considered in this study are expenses for office supplies in these functional areas because such data are not separately available. As it is likely that such expenses are either negligibly small, or not significantly affected by automation, this omission cannot be serious.

In order to present a clear picture, imputed interest has *not* been included in the total figure for the clerical work area. This is because although office automation might conceivably affect accounts receivable balances, hence also the imputed interest charge, a distinct direct relationship would be difficult to demonstrate. Similarly, losses from bad debts are not included in the total figure.[10]

### 3.1.3 *Methods of Calculation*

Of the expenses included in the total, payroll expenses may be obtained directly from the Harvard publication. All other expenses however, require some

[10] For a breakdown of imputed interest expense and losses from bad debts associated with accounts receivables by volume class, see Table 11 on p. 16 of Reference 1.

calculation using the data given in the Harvard publication. The methods of calculation are shown below.

(a) Supplementary Benefits

The figure for the entire store is proportionately scaled down to a figure applicable to the expense centers considered. The scaling is done on the basis of payroll expenses in the expense center.

(b) Services Purchased

The figure for the entire store is reduced to what is applicable by subtracting from it those pertaining to (i) superintendency and building operations, (ii) sales promotion, (iii) material handling, and (iv) merchandising.

(c) Cost Equivalents of Employee Discounts

The figure for the entire store is proportionately scaled down to a figure that is applicable on the basis of payroll expenses. The method of calculation is the same one used to obtain the appropriate figure for supplementary benefits.

### 3.2 *Potential in Inventory Management Area*

Again, to obtain an indication of the potential for office automation in terms of present-day expenses, the same three steps as before are involved. The expense centers and the expenses to be included are described respectively in Sections 3.2.1 and 3.2.2. Methods of calculation, however, are omitted because they are the same ones already described in Section 3.1.3.

The results of this effort are shown in Exhibit 3. It may be seen that the total expense in dollars in the inventory management area (i.e., the desired potential) increases more than proportionately with the net sales of the volume classes. As a percentage of net sales this total ranges from about 4.9 % for the low-volume class to about 6.0 % for the high-volume class. In all cases more than 60 % of this total is attributable to inventory-related expenses (i.e., imputed interest and stock shortage), the remainder to payroll-related expenses.

### 3.2.1 *Expense Centers Included*

In terms of the NRMA's Expense Center Accounting System, the 700 MATERIAL HANDLING group and the 900 MERCHANDISING group are relevant; but not all expense centers in these groups are applicable. Considered here are 720 RECEIVING & RETURNS TO VENDORS, 730 CHECKING AND MARKING, 840 MAINTENANCE OF STOCK, and 910 MERCHANDISING MANAGEMENT expense centers. Justification for doing so may be found in the definitions given in the NRMA manual.

### 3.2.2 *Expenses Included*

The expenses considered here are (a) those related to payroll, and (b) those related to inventory, excepting the cost of goods. Expenses related to payroll (i.e., employee benefits and employee discounts) are calculated by a method

| Description | Volume Class in Millions of Dollars | | | | | |
|---|---|---|---|---|---|---|
| | 1–2 | 2–5 | 5–10 | 10–20 | 20–50 | Over 50 |
| **Payroll Related Expenses %** | | | | | | |
| 720—Receiving & Returns to Vendors | | .21 | .19 | .18 | .18 | .18 |
| 730—Checking & Marking | | .46 | .44 | .43 | .45 | .44 |
| 840—Maintenance of Stock | | .33 | .35 | .60 | .70 | .81 |
| 910—Merchandise Management | | .77 | .79 | .80 | .81 | .66 |
| Total Payroll Related Expenses % | | 1.79 | 1.77 | 2.01 | 2.14 | 2.09 |
| **Inventory Related Expenses %** | | | | | | |
| Imputed Interest | 2.13 | 2.21 | 2.23 | 2.41 | 2.40 | 2.43 |
| Stock Shortage | 1.09 | 0.87 | 1.00 | 1.11 | 1.18 | 1.48 |
| Total Inventory Related Expenses % | 3.22 | 3.08 | 3.23 | 3.52 | 3.58 | 3.91 |
| **Total Expenses Attributable to Inventory Management** | | | | | | |
| % of Net Sales in Owned Departments | | 4.87 | 5.00 | 5.53 | 5.72 | 6.00 |
| $ Amount (Thousands $) | | 142 | 335 | 675 | 1,555 | 4,511 |

*Exhibit 3. Total Annual Expenses Attributable to Inventory Management in U. S. Department Stores by Volume Class, 1962*

Note: Net Sales in Owned Departments = 100%
Source of Data: "Operating Results of Department and Specialty Stores in 1962", M. P. McNair, Harvard Business School

similar to that used previously. Expenses related to inventory include the imputed interest charges (6%) and the stock shortages, both directly obtainable from the Harvard publication. Contrary to what was done in the clerical work area, imputed interest charges are included here. This is based upon the fact that the introduction of data processing to inventory management has often resulted in a reduction in the average stock level in other industries.

As was done previously, office supplies were omitted. Omitted also are the expenses for services purchased, since from the definitions given in the NRMA manual these services do not appear to be inventory-management oriented.

### 4. Discussion

It is not the purpose of this paper to depict the "true" value of modern information-processing technology in department stores. The final results shown in Exhibits 2 and 3 reflect only a partial picture. There are two explanations. First, only two areas in the department store are considered, namely, the clerical work area and the inventory management area; even though these are major areas in the sense that they are areas in which electronic computers have been used most in other industries.

Secondly, what is shown in this paper as potential is only the quantitatively measurable potential. In the vernacular of early data-processing days, this is the potential of the data-processing systems to "save money," not to "make money" for their users. It has long been known that the real value of modern information processing technology lies in its capability to extend the decision-making powers of management. Current literature in management science and data-processing abounds in expositions of this thesis. It is not necessary to go into details here. Suffice it to remark that potential in this sense is largely subjective and qualitative. It is rare that a measure can be arrived at that is meaningful and generally acceptable. This study has, therefore, chosen to interpret potential in a narrow but measurable sense.

Under the restricted interpretation of potential just explained, it is clear from Exhibits 2 and 3 that the potential for office automation in the high-volume department stores is considerably higher than that in the low-volume stores. Indeed, the relative magnitudes are at least proportional to the relative magnitudes of net sales. Such a statement however, applies only to individual firms. It is not certain if the high-volume class of stores as a group still have the greater potential than the low-volume class. Available stratification data on the department store population are rather sketchy to be of assistance in answering this question.

A few other observations on the results shown in Exhibits 2 and 3 are pertinent here. All of these have to do, in one way or another, with the raw data [1] used in this study. These observations are listed below.

(a) As noted previously, although present office equipment costs or rentals are quite germane to estimating the potential for office automation, they are not considered in this study. This is because such figures are not separately available for use.

(b) Figures for the low-volume classes are sometimes not given in the Exhibits. This is because adequate data are not available to permit the calculations required.

(c) Finally, limitations of the raw data must necessarily qualify the results of this study also. It is particularly appropriate to mention again the following:

   (i) The stores covered by Harvard are the "traditional" department stores.

  (ii) Some of the stores are Canadian stores.

 (iii) The reporting unit of the sample is the firm, not the individual establishment.

 (iv) A "typical" value is the interquartile average.

### References

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