STUDY OF THE

DENNISON COPYING SERVICE

# 370 - 67

AUTHOR: J. Myers

COMMUNITY SYSTEMS FOUNDATION
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</tbody>
</table>
SYNOPSIS
PURPOSE:

The purpose of this report is to determine whether the present system of Dennison reproduction is economical, profitable, and yields the best customer service.

SUMMARY:

Data were gathered on the costs associated with the Dennison reproduction service from which an analysis was made. The costs included supplies, service contracts, daily servicing, overhead, and 5-year straight line depreciation. The analysis showed that profit was being generated on every copy made at the present charging rate of a dime a copy.

Different charging systems were studied to determine whether or not a savings could be made for students using the Dennison service. Two systems were analyzed: a) $0.05 per letter size (8 1/2" x 14") copy; b) 3 letter or legal size copies for $.25. Of these two the adoption of a charging system of 3 copies for a quarter seems more conducive to the present demand patterns.

Because of the recent introduction of a Xerox coin operated copier into the market, a comparison between Xerox and Dennison copiers was made. From the comparison, Dennison copiers were shown to be better than Xerox copiers as self-service copiers.
BACKGROUND
Sixteen Dennison copiers are located in the various libraries on campus. Introduced in 1966, these copiers provide coin operated self-service copying facilities. An electrostatic copying machine, the Dennison Copier operates on the principle of a photoelectrically sensitive element built into the copying paper rather than the machine. Copying is simple: the user simply places the original on the exposure plate, drops a dime in the coin slot, presses the button for letter (8 1/2" x 11") or legal (8 1/2" x 14") size, then presses the "print" button.

Presently, the Dennison copying service consists primarily of cash sales, but there are also interlibrary loans, and departmental orders. Departmental orders involve only one copier located in the Physics and Astronomy Library. Attached to this copier is a cost controller which records the number of copies made by the different departments using special keys which allow them to make copies on credit. From the cost controller's records the charges are determined and the departments billed. This existing system of the Dennison service charges $.10 per copy regardless of the copy size and the classification of the three aforementioned user types.

Prior to the introduction of the Dennison copiers, all quick copying was done on the Xerox 914 copier which required a full-time attendant. At this time Xerographing was growing at the rate of 40% annually. (See Appendix A). As the demand for Quick Copy Service grew, a need arose for more copiers.
Furthermore, increased labor costs associated with the full-time attendant created a need for self-service copiers. This need was filled by the Dennison Copiers. The Dennison Copiers, by virtue of their convenience and availability to the students, captured some of Xerox's Quick Copy market. During the past fiscal year there was a decrease of $8,567.67 in Xerox Quick Copy revenue, from 1965-66. This difference, however, is more than balanced by the revenue collected from the Dennison coin operated copiers. Last year the Dennison-copying service alone generated an income of $32,682.20 which was 27.5% of the total revenue of the Photoduplication Service.

With an increase in the availability of the copiers across campus and rising student familiarity with their existence and use, the Dennison operation will have continued growth. It is estimated that Dennison copying will have a growth rate of 40% annually, similar to that which Xerox quick copying experienced.
COST ANALYSIS
Costs directly associated with Dennison copy service are supplies, service contracts, daily servicing, overhead, and depreciation. (See Appendix C).

SUPPLIES:

Supplies needed for the copiers include paper, toner, and intensifier. The paper is supplied in rolls 688 feet long, each of which lasts between 590 and 750 copies, depending on the number of copies which are of letter (8 1/2" x 11") and legal (8 1/2" x 14") sizes. The supervisor of Photoduplication Service estimates that 50% of the copies made are of letter size and the other 50% are of legal size. With this estimated demand pattern, one roll of paper lasts an average of 650 copies, including waste. At $16.28 per roll, paper costs $.02504 per copy. If only letter size copies were made one roll of paper would last 750 copies, with the paper costing $.021701 per copy. If only legal size copies were made, one roll of paper would last 590 copies, at a cost of $.027593 per copy.

Every roll of paper requires one bottle of toner which costs $2.20. With one roll of paper lasting 750, 650 and 590 copies, depending on the size and demand pattern, toner cost per copy is $.002933, $.003385, and $.003729, respectively.

Intensifier costs are minimal. One bottle of intensifier will last nearly 12,000 copies, independent of size and demand pattern. The cost for the intensifier is $.000758 per copy at $5.50 per bottle.
SUMMARY OF THE COST OF SUPPLIES PER COPY:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>LETTER SIZE</th>
<th>50% LETTER-50% LEGAL</th>
<th>LEGAL SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>$ .021701</td>
<td>$.025046</td>
<td>$ .027593</td>
</tr>
<tr>
<td>Toner</td>
<td>.002933</td>
<td>.003385</td>
<td>.003729</td>
</tr>
<tr>
<td>Intensifier</td>
<td>.000458</td>
<td>.000458</td>
<td>.000458</td>
</tr>
<tr>
<td>Total cost per copy</td>
<td>$ .025092</td>
<td>$.028889</td>
<td>$ .031780</td>
</tr>
</tbody>
</table>

SERVICE CONTRACTS:

Every machine is under a service contract which pledges a minimum of six calls, as required, per year. On each call a Dennison representative will clean, inspect, adjust and replace all necessary parts at cost. With the contract costing $120 a year per copier, and 326, 822 copies made this year, the service contract's contribution to the cost of each copy is $.005140. We can assume that this amount will be constant throughout the life of the machines, using the following argument: Although the cost per copy will decrease as the number of copies made increases, the number of machines will increase to meet this higher demand, increasing the cost per copy, resulting in a cancelling effect.

DAILY SERVICING:

Servicing is done daily and consists of the collecting of money and the checking of supplies. With the effective hourly cost at $1.67 per hour for 20 hours a week, the daily serviceman contributes $.005314 to the cost of each copy. Like the cost per copy of the
-service contract, the cost per copy of daily servicing can be assumed constant.

OVERHEAD:

Overhead, which includes administrative expenses and depreciation of office equipment, costs $6,284.13 annually. The overhead cost per copy is $.019228 (constant).

The following is a summary of the cost analysis, not including depreciation:

<table>
<thead>
<tr>
<th>SUPPLIES</th>
<th>LETTER SIZE</th>
<th>50%-50%</th>
<th>LEGAL SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>$.021701</td>
<td>$.025046</td>
<td>$.027593</td>
</tr>
<tr>
<td>Toner</td>
<td>.002933</td>
<td>.003385</td>
<td>.003729</td>
</tr>
<tr>
<td>Intensifier</td>
<td>.000458</td>
<td>.000458</td>
<td>.000458</td>
</tr>
<tr>
<td></td>
<td>$.025092</td>
<td>$.028889</td>
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<td>Service Contracts</td>
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<td>.005140</td>
<td>.005140</td>
</tr>
<tr>
<td>Daily servicing</td>
<td>.005314</td>
<td>.005314</td>
<td>.005314</td>
</tr>
<tr>
<td>Overhead</td>
<td>.019228</td>
<td>.019228</td>
<td>.019228</td>
</tr>
<tr>
<td>Total cost per copy</td>
<td>$.054774</td>
<td>$.058571</td>
<td>$.061462</td>
</tr>
</tbody>
</table>

DEPRECIATION:

The cost of each Dennison copier is $2500. For the present system which contains 16 machines, the total cost of the copiers is $40,000. Presently, this amount is being written off over a 5-year period by a 5-year straight line depreciation method. With this depreciation schedule and a $0.10 charge per copy, profit is gene-
rated on each copy made.

**TOTAL COST PER COPY - 16 COPIERS:**

<table>
<thead>
<tr>
<th></th>
<th>LETTER SIZE</th>
<th>50% - 50%</th>
<th>LEGAL SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$ .054774</td>
<td>$ .058571</td>
<td>$ .061462</td>
</tr>
<tr>
<td>Depreciation</td>
<td>.024478</td>
<td>.024478</td>
<td>.024478</td>
</tr>
<tr>
<td>Total Cost per copy</td>
<td>$ .079252</td>
<td>$ .083049</td>
<td>$ .085940</td>
</tr>
</tbody>
</table>

Within 5 years Photoduplication Service can expect to make a minimum of $18,000 profit with just 16 machines and $32,682.20 revenue per year from the Dennison copiers.

Quick copy service during the past four years has grown at an incredible rate, 40% annually. To continue to grow at 40% for the next five years, Photoduplication Service needs to expand its quick copy operation and improve the availability of the Dennison Copiers. Increasing the present number of copiers to 30 would assure at least one copier in every divisional, departmental, and special library and more than one copier at high usage areas, i.e., the Undergraduate Library and the General Library. If all 30 copiers are to be depreciated in 5 years, the total amount that would be depreciated is $75,000, the cost of 30 copiers.

An increase in the total number of copiers and an annual growth rate of 40% would bring the cumulative total number of copies made in 5 years to 3,557,262. The depreciation rate, accounting for growth, is $.021084 per copy.
Estimated 5 Years Cumulative Expenses and Revenues

50% Letter Size - 50% Legal Size
5 Year Straight Line Depreciation
40% Growth Rate
Copy Charge: $0.10 A Copy

TOTAL REVENUES @ $1.00 COPI

TOTAL EXPENSES

DEPRECIATION

SUPPLIES

OVERHEAD

DAILY SERVICING SERVICE CONTRACTS

Year

$300,000

$200,000

$100,000

$0
At a charge of $0.10 per copy, a profit is still generated on each copy made. Photoduplication Service can expect a cumulative profit of $85,000 at the end of 5 years with continued growth and expansion. (See graph).

TOTAL COST PER COPY - 30 COPIERS:

<table>
<thead>
<tr>
<th></th>
<th>LETTER SIZE</th>
<th>50% - 50%</th>
<th>LEGAL SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$0.054774</td>
<td>$0.058571</td>
<td>$0.061462</td>
</tr>
<tr>
<td>Depreciation</td>
<td>$0.021084</td>
<td>$0.021084</td>
<td>$0.021084</td>
</tr>
<tr>
<td>Total Cost per Copy</td>
<td>$0.075858</td>
<td>$0.079625</td>
<td>$0.082546</td>
</tr>
</tbody>
</table>

Note that a 5 year straight line depreciation method has been used. Other methods of depreciation exist, but no other method of writing off the copiers is as practical.

If all the copies made were of letter size, Photoduplication could write off as much as $.045226 per copy for depreciation under the present charge system of $0.10 per copy and still break even. After 1,719,907 copies or a minimum of 3.3 years (See Appendix B) all 30 copiers would have a book value of zero.

If the demand pattern was 50% letter and 50% legal size, depreciation could be as much as $.041429 per copy with a $0.10 charge per copy. It would take only 1,853,945 copies, or about 3.5 years, to depreciate all 30 copiers completely. If all copies made were of legal size, depreciation could be as much as $.038538. Writing off all 30 copiers would require 2,031,474 copies, or about 3.67 years.
### SUMMARY OF DEPRECIATION ANALYSIS

<table>
<thead>
<tr>
<th>Size</th>
<th>Max. Depreciation Rate Per Copy</th>
<th>Min. Copies to Break Even</th>
<th>Min. Time to Break Even</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter size</td>
<td>$0.043607</td>
<td>1,719,907</td>
<td>3.3 years</td>
</tr>
<tr>
<td>50% Legal-50%</td>
<td>0.039810</td>
<td>1,883,945</td>
<td>3.5 years</td>
</tr>
<tr>
<td>Legal size</td>
<td>0.036919</td>
<td>2,031,474</td>
<td>3.7 years</td>
</tr>
</tbody>
</table>

It would be possible to charge the maximum depreciation rate but if this is done the book value of the copiers will not extend beyond 3.7 years. The Dennison copiers have an estimated life span of at least 5 years. For the first 3.7 years the Dennison copying service would show no profit, after which it will show as much as $0.045226 profit per copy. The total profit at the end of five years would be the same, but the books will show profits only after all the copiers are written off. This same temporary deception would occur if the depreciation rate was greater than the amount needed to break even: losses would be incurred during the early life of the copier, after which profit would be generated. Preferably depreciation should be spread over the entire life of the copiers. Therefore, a 5 year straight line depreciation method is better.

**INTERLIBRARY LOAN:**

Whenever there is a request from Interlibrary Loan for copies of articles or manuscripts from divisional or departmental libraries, reproduction is done by a salaried employee of the Photoduplication Service using the Dennison copier.
This man spends approximately 1.5 hours per day and costs an effective rate of $3.16 per hour. Photoduplication Service pays him $1206 a year for work done for Interlibrary Loan. This labor cost should be paid for by Interlibrary Loan because it is incurred for work done for them. Photoduplication should not be held responsible for this additional expense. Therefore, the cost of this labor has not been considered as an expense directly connected with Dennison reproduction. Furthermore, with approximately 8500 copies being made for Interlibrary Loan annually, the labor cost per copy is about $.142 bringing the total cost per copy to as much as $.224546. Since Photoduplication charges only a dime per copy, it is losing as much as $.124426 per copy or $1058 per year on Interlibrary Loan work.

The reasoning behind sending a man to the divisional libraries for Interlibrary Loan work is to assure the library that the books will be available when needed. This policy is costing Photoduplication more than $1206 a year. It is a high price to pay to keep the books in the libraries.

The present policy of Interlibrary Loan copying should be deliberated upon to save on labor costs. The books could be sent to Photoduplication Service in the General Library where labor costs are lower. If the divisional libraries cannot spare the books to Photoduplication, the request should be marked "unavailable for Interlibrary Loan".
## SUMMARY OF COST ANALYSIS

### 5 Year Straight Line Depreciation

<table>
<thead>
<tr>
<th>Supplies</th>
<th>LETTER SIZE</th>
<th>50% - 50%</th>
<th>LEGAL SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>$ .021701</td>
<td>$ .025046</td>
<td>$ .027593</td>
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<tr>
<td>Intensifier</td>
<td>.000458</td>
<td>.000458</td>
<td>.000458</td>
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<tr>
<td></td>
<td>$ .025092</td>
<td>$ .028889</td>
<td>$ .031780</td>
</tr>
<tr>
<td>Service Contracts</td>
<td>.005140</td>
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<tr>
<td>Daily Servicing</td>
<td>.005314</td>
<td>.005314</td>
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</tr>
<tr>
<td>Overhead</td>
<td>.019228</td>
<td>.019228</td>
<td>.019228</td>
</tr>
<tr>
<td>Depreciation</td>
<td>.021084</td>
<td>.021084</td>
<td>.021084</td>
</tr>
<tr>
<td>Total Cost per Copy</td>
<td>$ .075858</td>
<td>$ .079625</td>
<td>$ .082546</td>
</tr>
</tbody>
</table>
PRICE PLANS
The present system charges $.10 a copy for both letter and legal sizes. Profit is generated from both sizes, $.024142 per letter size copy and $.017454 per legal size copy. Studies were made to determine if it was possible to make price changes which would significantly reduce the cost of copies for students. (See Appendix E).

A charging system of $.05 for letter size and $.10 for legal size copies might be possible, operating on the principle that losses from letter size copies would be covered by the profits made on the legal size copies. For every one letter size copy made, 1.48 legal size copies must be made in order to break even, because there is a loss of $.025858 per letter size copy and only a profit of $.017454 per legal size copy. Only if more than 67.5% of all copies made were of legal size would this charging plan prove profitable.

The advantage to the students is obvious. The big disadvantage, however, is the high probability that more letter size copies will be made because of the lesser charge and, thereby, a greater loss incurred than that which can be covered by the profits of the legal size copies.

A charging system of 3 copies for $.25 results in a profit from both letter and legal sizes. This charge plan is unlike the previous one which lost money on one size, hoping it would make up the difference from the profits on the other size. A set of 3 letter size copies generates $.022426 profit on each transaction and a set of 3 legal size copies generates $.002362 profit on each transaction.
If during the past year all the copies were sold in multiples of three and charged a quarter for three copies, a profit of $2630.05 would have been made on letter size copies and $257.32 on legal size copies, as opposed to $7890.14 on letter size copies and $5704.35 on legal size copies at $.10 per letter and legal size copy.

**Comparison of Profits**

<table>
<thead>
<tr>
<th>Charge Systems</th>
<th>Letter Size</th>
<th>Legal Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>$.10 / copy</td>
<td>$7890.14</td>
<td>$5704.35</td>
</tr>
<tr>
<td>$.25 / 3 copies</td>
<td>$2630.05</td>
<td>$257.32</td>
</tr>
<tr>
<td>Difference</td>
<td>$5260.09</td>
<td>$5447.03</td>
</tr>
</tbody>
</table>

Though profit is generated from either charge system, there would be a significant decrease in profits at three copies for $.25, as much as $5,447. It is important to discuss Photoduplication's policies for the distribution of its profits to determine whether such a decrease could be sustained. Photoduplication uses its profits to subsidize losses incurred from its other operations, such as microfilm enlargements and photostating. Furthermore, it uses its profits to innovate new ideas and introduce new machines. An example of this is the Dennison self-service copiers made possible by profits from Xerography.

Perhaps, with the quarter charge plan the losses from microfilm enlargements and photostating could not be covered. Or perhaps, the decrease in price would stimulate volume cancelling the effect of the decrease in the profit per copy, and, therefore, generate the same amount of profit.
It is difficult to predict the demand patterns under the new charge plan. To determine what kind of effect it will have on Photoduplication Service a test of its profitability could be made. One copier put in the Undergraduate and/or General Library would be sufficient in providing data for the test. The test could include data from a quarter charge plan for both letter and legal size copies and for only letter size copies. If the quarter charge system does stimulate volume, it should be implemented in other areas. Otherwise, a change back to the dime a copy charge should be made. The only cost that would be contracted in implementing the quarter charge plan is the cost of the new coin box. The practicality of the quarter charge plan is also uncertain, though, because to provide the optimal service every library would need two copiers, one for single copies of letter and legal sizes and one for sets of three letter and legal size copies to provide both types of service in all libraries. This would be impossible because of the low usage of the copiers in some libraries. The charging system of 3 copies for $.25 could operate only in areas of high usage where more than one copier already exists. The other copiers would continue with the present system of $.10 a copy, letter or legal size. An added problem is the demand for a number of copies which is not a multiple of three. Of course, any remaining copies could be made on the regular $0.10 machine.
COIN OPERATED COPIERS
DENNISON vs. XEROX
A coin operated copying machine has been introduced to the market by Xerox Corporation. It is nothing more than a regular Xerox 914 copier with a coin box and coin activating mechanism attached.

Xerox does not sell its machine outright, but charges $.035 per copy plus $25 a month rent on the copier. Unlike Xerox, Dennison sells their copiers outright at $2500 each. Xerox's copy charge and rent are comparable functionally to Dennison's 5 year depreciation per copy rate, a cost which is only two-thirds as much as the Xerox copy charge alone.

The Xerox copier has a selenium drum which is essential to the copying process. It must be kept scratch-free. Therefore, the Xerox is more sensitive to abuse than the Dennison copier. This drum, even without abuse, needs replacing every 20,000 copies.

At the present rate of growth, quick copy service will require about 63 drums a year in 5 years. The cost of each drum is $105. Therefore, $6,615 a year will be spent on the drum replacement alone. Dennison, with its service contracts, will cost only $3600 on 30 copiers, one half of Xerox's projected maintenance expense. Furthermore, at present the Dennison service contracts require only 6 maintenance calls per copier, but a Dennison representative checks every copier every day free of charge.

The type and cost of paper is one of the significant differences between the Xerox and Dennison copier. The difference in the cost of paper can be as much as $.03 per copy.
This difference is due to the specially treated paper used by the Dennison copier. Paper for Xerox copiers can be of any quality or type, so that its paper costs can be as low as $.013 per sheet, a great savings over Dennison copiers.

The Dennison copier holds one roll of paper from which as many as 750 copies can be made. With a flip of a switch, the Dennison copier can make either letter or legal size copies. Xerox copiers can hold at maximum 150 sheets, and these sheets must all be of the same size.

The cost of servicing a Xerox copier would be very high because of its low capacity. And, also, because it can hold just one size of paper, there would be a need for two Xerox copiers for every one Dennison to provide the student with a service similar to that which is now available.

From the cost comparison between Xerox and Dennison copies which follows, it is revealed that a Dennison copy of the same size costs $.0241 less than a Xerox copy.

Comparing the Xerox and Dennison copiers, one finds that the Dennison is more economical, profitable, and practical for the University of Michigan Library system.
<table>
<thead>
<tr>
<th>Supplies:</th>
<th>DENNISON</th>
<th>XEROX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>$ .021701</td>
<td>$ .0034</td>
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<td>Toner</td>
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<td>Service Contracts</td>
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<td>.0243</td>
</tr>
</tbody>
</table>

| Total Cost per Copy | $ .075858 | $ .1000 |
CONCLUSION
The case analysis indicates that the present system of Dennison reproduction is yielding profit on every copy made, letter or legal size. The present charge system of $0.10 a copy is the most practical and profitable of the alternatives considered. It is recommended, however, that a charge system of a quarter for sets of 3 copies of letter and/or legal size be tested and implemented in the Undergraduate and General Libraries, to provide better service to the students. When other libraries get high usage on their copiers, and require more than one copier, the quarter charge system should be implemented there, also.

The comparison between Dennison and Xerox coin operated copiers reveals that the only advantage of the Xerox copier is its low paper cost, an advantage which is mitigated by higher costs in other areas. Therefore, since Dennison copiers make copies for less than Xerox copiers do, it is recommended that only Dennison copiers be bought.
APPENDICES
APPENDIX A

REVENUES FROM XEROX AND DENNISON OPERATIONS 1963-1967

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Revenues</th>
<th>% of Total Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 - 64</td>
<td>$34,265.85</td>
<td>45%</td>
</tr>
<tr>
<td>64 - 65</td>
<td>$54,723.44</td>
<td>64%</td>
</tr>
<tr>
<td>65 - 66</td>
<td>$67,271.03</td>
<td>60%</td>
</tr>
<tr>
<td>66 - 67</td>
<td>$91,385.56</td>
<td>76%</td>
</tr>
</tbody>
</table>

\[
\frac{\$54,723.44 - \$34,265.85}{\$34,265.85} = 59.7\%
\]

\[
\frac{\$67,271.03 - \$54,723.44}{\$54,723.44} = 23.0\%
\]

\[
\frac{\$91,385.56 - \$67,271.03}{\$67,271.03} = 35.9\%
\]

\[
\frac{118.6}{3} = 39.5\%
\]

Increase per Year: 39.5%
APPENDIX A

REVENUES FROM XEROX AND DENNISON OPERATIONS 1963-1967

39.5% INCREASE IN REVENUES PER YEAR
**Appendix B**

**Number of Dennison Copies/Year for the Next 5 Years at 40% Growth Rate**

<table>
<thead>
<tr>
<th>Year</th>
<th>$\text{Log Copies - Year } x$</th>
<th>$\text{Log Copies up to Year } x$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>326,822</td>
<td>326,822</td>
</tr>
<tr>
<td>2</td>
<td>457,551</td>
<td>784,373</td>
</tr>
<tr>
<td>3</td>
<td>640,571</td>
<td>1,424,944</td>
</tr>
<tr>
<td>4</td>
<td>894,799</td>
<td>2,321,743</td>
</tr>
<tr>
<td>5</td>
<td>1,255,519</td>
<td>3,577,262</td>
</tr>
</tbody>
</table>

**Scale:** Log Copies to Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Log Copies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,000,000</td>
</tr>
<tr>
<td>2</td>
<td>2,000,000</td>
</tr>
<tr>
<td>3</td>
<td>3,000,000</td>
</tr>
<tr>
<td>4</td>
<td>4,000,000</td>
</tr>
</tbody>
</table>

10 Millimeters to the Centimeter
APPENDIX C

COST ANALYSIS CALCULATIONS

I. SUPPLIES:

A. Paper: 1 roll, 688 feet - at $16.28

1. 50% letter size - 50% legal size

a) Copies per roll:

\[
\frac{11 \text{ inches} + 14 \text{ inches}}{2} \times \frac{12 \text{ inches}}{\text{Foot}} \times \frac{688 \text{ feet}}{\text{Roll}} \times \frac{650 \text{ copies per roll}}{(\text{less waste})} \]

b) Cost per copy:

\[
\frac{$16.28}{\text{Roll}} \times \frac{1 \text{ roll}}{650 \text{ copies}} = \frac{\$.025046}{\text{copy}}
\]

2. Letter size

a) Copies per roll

\[
\frac{685 \text{ Feet}}{\text{Roll}} \times \frac{12 \text{ inches}}{\text{Feet}} \times \frac{1 \text{ copy}}{11 \text{ inches}} \div \frac{750 \text{ copies}}{\text{Roll}}
\]

b) Cost per copy

\[
\frac{$16.28}{\text{Roll}} \times \frac{1 \text{ roll}}{750 \text{ copies}} = \frac{\$.021701}{\text{copy}}
\]

3. Legal size

a) Copies per roll

\[
\frac{688 \text{ Feet}}{\text{Roll}} \times \frac{12 \text{ inches}}{\text{Feet}} \times \frac{1 \text{ copy}}{14 \text{ inches}} \div \frac{590 \text{ copies}}{\text{Roll}}
\]

b) Cost per copy

\[
\frac{$16.28}{\text{Roll}} \times \frac{1 \text{ roll}}{590 \text{ copies}} = \frac{\$.027593}{\text{copy}}
\]
B. Toner: 1 bottle per roll of paper - at $2.20

1. 50% letter - 50% legal

   Cost per copy:

   \[
   \frac{2.20}{\text{bottle}} \times \frac{1 \text{ bottle}}{650 \text{ copies}} = \frac{.003385}{\text{copy}}
   \]

2. Letter size

   Cost per copy:

   \[
   \frac{2.20}{\text{bottle}} \times \frac{1 \text{ bottle}}{750 \text{ copies}} = \frac{.002933}{\text{copy}}
   \]

3. Legal size

   Cost per copy:

   \[
   \frac{2.20}{\text{bottle}} \times \frac{1 \text{ bottle}}{590 \text{ copies}} = \frac{.003729}{\text{copy}}
   \]

C. Intensifier: 1 bottle per 12,000 copies - at $5.50

   Cost per copy:

   \[
   \frac{5.50}{\text{bottle}} \times \frac{1 \text{ bottle}}{12,000 \text{ copies}} = \frac{.000458}{\text{copy}}
   \]

II. SERVICE CONTRACTS: $120 per copier per year.

   Cost per copy:

   \[
   \frac{120/\text{year}}{\text{copier}} \times \frac{16 \text{ copiers \times 1 year}}{326,822 \text{ copies}} = \frac{.005140}{\text{copy}}
   \]
III. EFFECTIVE LABOR COST OF THE DAILY SERVICEMAN:

A. Effective hourly labor rate at a nominal rate of $1.40 per hour:

1. Wage
   
   1.40

2. No fringe benefits or taxes are paid for hourly employees
   
   .00

   Cost $ 1.40

   Paid Hour

B. Average productive hours per hour paid:

1. Start with one hour paid
   
   1.00

2. No allowances for vacation, holidays, or sick time
   
   .00

3. Coffee breaks (25% of the time. No break 75% of the time. 15 min./4 hours)
   
   -.05

4. Personal time (3%) +
   Fatigue (3%) +
   Delay allowance (5%) = 11% = .11

   Productive hours .84

   Paid hour

C. Effective hourly cost:

\[
\frac{1.40 \text{ cost $ paid hour}}{.84 \text{ productive hour/paid hour}} = $ 1.67 \text{ / hour}
\]

D. Effective yearly labor cost:

\[
\frac{1.67 \text{ hour}}{20 \text{ hours\ week}} \times \frac{52 \text{ weeks\ year}}{} = $1736.80 \text{ / year}
\]

E. Effective labor cost per copy:

\[
\frac{1736.80 \text{ year}}{326,822 \text{ copies}} = $ .005314 \text{ / copy}
\]
IV. OVERHEAD (Appendix D):

A. Dennison O/H = \( \frac{\text{Total O/H}}{\text{Total Revenue}} \times \text{Dennison Revenue} \)

\[ = \frac{\$22,827.17}{\$118,715.75} \times \$32,862.20 = \$6,284.13/\text{year} \]

B. Cost/Copy

\[ \frac{\$6,284}{\text{year}} \times \frac{1\text{ year}}{326,822 \text{ copies}} = \frac{\$0.019228}{\text{copy}} \]

V. DEPRECIATION:

A. Cost of copier

- Price of copier: $2550
- Less: Salvage value: 60
- Moving cost: 10
- COST/COPIER: $2500

B. 5 Year Straight Line Depreciation - 16 copiers

1. Depreciation per copy

\[ \frac{16 \times \$2500 \times 1\text{ year}}{5 \text{ years} \times 326,822 \text{ copies}} = \frac{\$0.021378}{\text{copy}} \]

2. Minimum Cumulative Profit in 5 Years

\[ (\$0.100000 - \$0.082546) \times \frac{326,822 \text{ copies}}{\text{year}} \times 5 \text{ years} \]

$18,000.
C. 5 Year Straight Line Depreciation - 30 copiers, 40% growth rate

Depreciation per copy

\[
\frac{30 \times 2500}{3,557,262 \text{ copies}} = 0.021084 \text{ per copy}
\]

VI. EFFECTIVE LABOR COST FOR INTERLIBRARY LOAN MAN:

A. Total Cost of Salary

1. Salary $4320.00

2. Fringe Benefits and Taxes (FICA, etc.) = 12% $518.40

Effective salary $4838.40

B. Productive Hours per Year

1. Hours per year (gross = 52 x 40) 2080.0
2. Two weeks vacation - 80.0
3. Twelve days sick leave - 96.0
4. Six holidays & one "floating" holiday - 56.0

ACTUAL HOURS IN LIBRARY 1848.0

5. Coffee breaks (15 min./4 hours worked) - 115.5
6. Personal time (3%) + fatigue (3%) + delay allowances (5%) = 11\% - 203.3

TOTAL ANNUAL PRODUCTIVE HOURS 1529.2

C. Effective Hourly Cost

\[
\frac{4838.40/\text{year}}{1529.2 \text{ hrs/} \text{year}} = 3.164/\text{ hour}
\]
D. Effective Yearly Cost
\[
\frac{\$3.164 \times 1.5 \text{ hours} \times 254 \text{ days}}{\text{hour} \times \text{day} \times \text{year}} = \$1205.99/\text{year}
\]

E. Effective Labor Cost per Copy
\[
\frac{\$1205.99 \times 1 \text{ year}}{\text{year} \times 8500 \text{ copies}} = \$ .14188/\text{copy}
\]

F. Profit Analysis of Interlibrary Loan
\[
\begin{align*}
\$ .082546 & \quad \text{Cost/copy (legal size)} \\
- .141880 & \quad \text{Labor} \\
\$ .224426 & \quad \text{Total cost/copy} \\
-.100000 & \quad \text{Charge/copy} \\
\$ .124426 & \quad \text{Loss/copy} \\
\times 8500 & \quad \text{Copies/year} \\
\approx \$ 1058 & \quad \text{Loss/year}
\end{align*}
\]
APPENDIX D
PHOTODUPLICATION SERVICE OVERHEAD

I. ADMINISTRATIVE SALARY EXPENSES:

A. Annual salary expense $16,716.00
B. Annual hourly wage expense 3,273.60
C. Fringe benefits (12%) 2,298.75

TOTAL ANNUAL HOURLY AND SALARIED ADMINISTRATIVE EXPENSE $22,388.35

II. DEPRECIATION OF OFFICE EQUIPMENT:

All equipment assumed to have a 10 year life.
(Straight line depreciation method)

A. Cost of office equipment

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>cabinet</td>
<td>115.97</td>
</tr>
<tr>
<td>chairs</td>
<td>109.50</td>
</tr>
<tr>
<td>books</td>
<td>40.00</td>
</tr>
<tr>
<td>adding machine</td>
<td>296.25</td>
</tr>
<tr>
<td>type writer</td>
<td>148.50</td>
</tr>
<tr>
<td>type writer</td>
<td>333.00</td>
</tr>
<tr>
<td>cash register</td>
<td>950.00</td>
</tr>
<tr>
<td>cabinet</td>
<td>42.21</td>
</tr>
<tr>
<td>safe</td>
<td>263.63</td>
</tr>
<tr>
<td>safe</td>
<td>263.83</td>
</tr>
<tr>
<td>desk</td>
<td>40.00</td>
</tr>
<tr>
<td>table</td>
<td>55.00</td>
</tr>
<tr>
<td>cabinet</td>
<td>91.02</td>
</tr>
<tr>
<td>cabinet</td>
<td>44.52</td>
</tr>
<tr>
<td>cabinet</td>
<td>48.72</td>
</tr>
<tr>
<td>cabinet</td>
<td>29.16</td>
</tr>
<tr>
<td>vice</td>
<td>97.16</td>
</tr>
</tbody>
</table>

TOTAL 2920.47

B. Depreciation cost per year

$292.05
C. Maintenance contracts

1. Cash register $ 50.00
2. Adding machine $ 36.00
3. Typewriters $ 60.77

**TOTAL MAINTENANCE CONTRACTS EXPENSE** $ 146.77

D. Total overhead

1. Annual hourly and salaried administrative expenses $22,388.35
2. Depreciation cost per year $ 292.05
3. Maintenance contracts $ 146.77

**OVERHEAD** $22,827.17
APPENDIX E
PRICE PLANS CALCULATIONS

I. PRESENT SYSTEM: $.10 a copy - letter and legal size

A. Letter size
   Charge $ .100000
   Cost/copy .075858
   Profit/copy $ .024142

B. Legal size
   Charge $ .100000
   Cost/copy .082546
   Profit/copy $ .017454

II. $.05 LETTER SIZE, $.10 LEGAL SIZE:

A. Letter size
   Cost/copy $ .075858
   Charge .050000
   Loss/copy $ .025858

B. Legal size
   Profit/copy $ .017454

C. Break even ratio

   \[
   \frac{\text{Loss/copy}}{\text{Profit/copy}} = \frac{.025858}{.017454} = 1.48
   \]

For every 1 letter size copy made, 1.48 legal size copies must be made in order to break even.
III. $.25 3 LETTER OR 3 LEGAL SIZE COPIES:

A. 3 letter size

Cost/copy $ .075858

\[ \times 3 \]

Cost/3 copies $ .222574

Charge $ .250000

Cost/3 copies $ .227574

Profit/3 copies $ .022426

B. 3 legal size

Cost/copy $ .082546

\[ \times 3 \]

Cost/3 copies $ .247638

Charge $ .250000

Cost/3 copies $ .247638

Profit/copy $ .002362

IV. COMPARISON OF PROFITS FOR ONE YEAR AT CHARGING SYSTEMS OF $.10 A COPY AND 3 COPIES FOR $.25:

A. Charging system: $.10 a copy

1. Letter size copies

\[ \$ .024142 \text{ profit/copy} \times 326,822 \text{ copies} = \$890.14 \text{ profit} \]

2. Legal size copies

\[ \$ .017454 \text{ profit/copy} \times 326,822 \text{ copies} = \$5709.35 \text{ profit} \]
B. Charging system $.25 for 3 copies

1. Letter size

\[
\frac{.024142 \text{ profit}}{3 \text{ copies}} \times 326,822 \text{ copies} = \underline{2630.05} \text{ profit}
\]

2. Legal size

\[
\frac{.002362 \text{ profit}}{3 \text{ copies}} \times 326,822 \text{ copies} = \underline{257.32} \text{ profit}
\]