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Publication Cost Analysis Techniques

by

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SYSTEM

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This paper describes the results obtained from analyzing past printing require-
ments at System Development Corporation and determining alternative methods of
printing, duplication, and distribution. The techniques used in determining
the costs for each of the several alternative methods are described, and
elements of cost discussed briefly. The techniques permit comparisons between
standard offset printing methods and conventional distribution of bound, paper
copies using less conventional publishing and distribution methods--aperture
cards, microfiche, and microfilm cartridges.

The cost appraisal methods are not dependent on the printing techniques used
by the System Development Corporation, but are equally applicable to any
company. The results, showing percentage differences between the alternative
methods, do reflect what we are doing, and how we charge for material, labor,
overhead, general and administrative expenses, and the like. But the techniques
are not company specific.

Seven different methods were investigated, involving three microforms. The
methods are tabulated below, along with the type and percentage of distribution
of each microform and a brief listing of characteristic features.

In our calculations, we used the actual page counts involved in publishing
change pages to two series of documents over a period of 43 months. We printed
over 27,000 change pages, with a total impression count in excess of 17 million.

The two series were approximately equal in dollar costs. However, for one
series we included a security handling charge, for the other series we did not.
Results are shown for the combined totals, and, in addition, where significant
differences do exist, the results for each of the series are also shown.

Since dollar figures are not particularly meaningful, results of the calcula-
tions used to determine costs for each method are expressed in percentages.
Standard print costs are shown as 100 percent, and all other costs are a
percentage of the standard print cost.

Table 1. Methods Investigated

METHOD	DISTRIBUTION	FEATURES
1. Standard Print Costs	100% Paper	Conventional plate generation and printing using offset lithography techniques.
2. Minimum Microfilm Costs	100% Paper	Aperture card-to-plate generation.
3. Aperture Card Distribution Costs	25% Paper 50% Duplicate aperture cards	Two, four, or eight page images per card.
4. Microfiche Set Distribution Costs	25% Paper 30% Duplicate fiche	55 page images per fiche. 100% replacement of fiche set every change.
5. Changed Microfiche Distribution Costs	25% Paper 30% Duplicate fiche	55 page images per fiche. Replacement only of fiche with changed page images.
6. Rollfilm Cartridge Distribution Costs	25% Paper 25% Cartridges	2,000 page images per cartridge. Film cost is averaged to the document, based on change experience of each book.
7. Cartridge and Aperture Card Distribution Costs	25% Paper 15% Cartridge 15% Aperture card	Same image count for microform as previously used.

Figure 1 shows costs as a percent of standard print costs. From this figure, we see that aperture card distribution using eight images per card cost only 55.8% of standard print costs. If we use four images per card, our costs increase to 85.3% of standard print costs. Before accepting the greater cost savings potential of the eight-image card, however, we must determine if our readers and reader-printers are compatible with the greater reduction ratio necessary to achieve the eight images per card.

Figure 2 compares the methods by percent savings of standard costs. We see that microfiche set distribution methods save 6.1% over standard print costs, and that we have a negative savings of almost 29% if we use two-image aperture cards. If we do not consider the trade-offs and other costs, such as readers, etc., but consider only the savings relative to standard print costs, we can rank the various techniques. Figure 3 shows the relative rankings of the methods.

In Figure 4, we see the impact of security handling charges on the relative costs for aperture card distribution. Savings using aperture cards of eight, four, and two images per card have been determined relative to standard print costs, with and without security handling charges. Also, the combined savings for both series of documents have been determined.

The formulas used to determine these results contain certain common elements:

1. Cost for platemaking.
2. Cost for printing paper copies.
3. Cost for handling and distribution.

To these elements were added:

4. Cost for generating original and duplicate aperture cards.
5. Cost for generating microfiche masters and duplicate fiche.
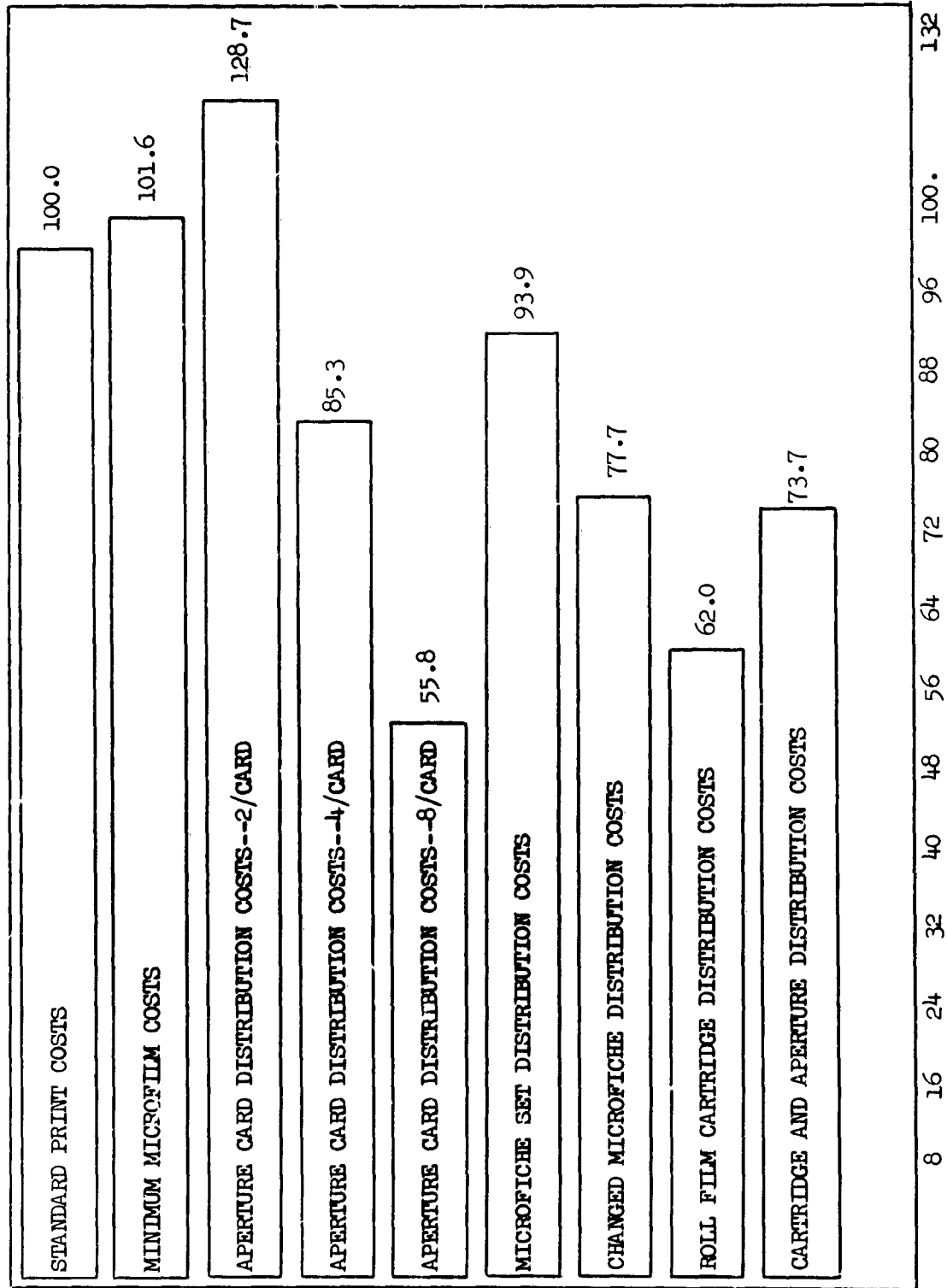6. Cost for generating roll-film originals and duplicates.

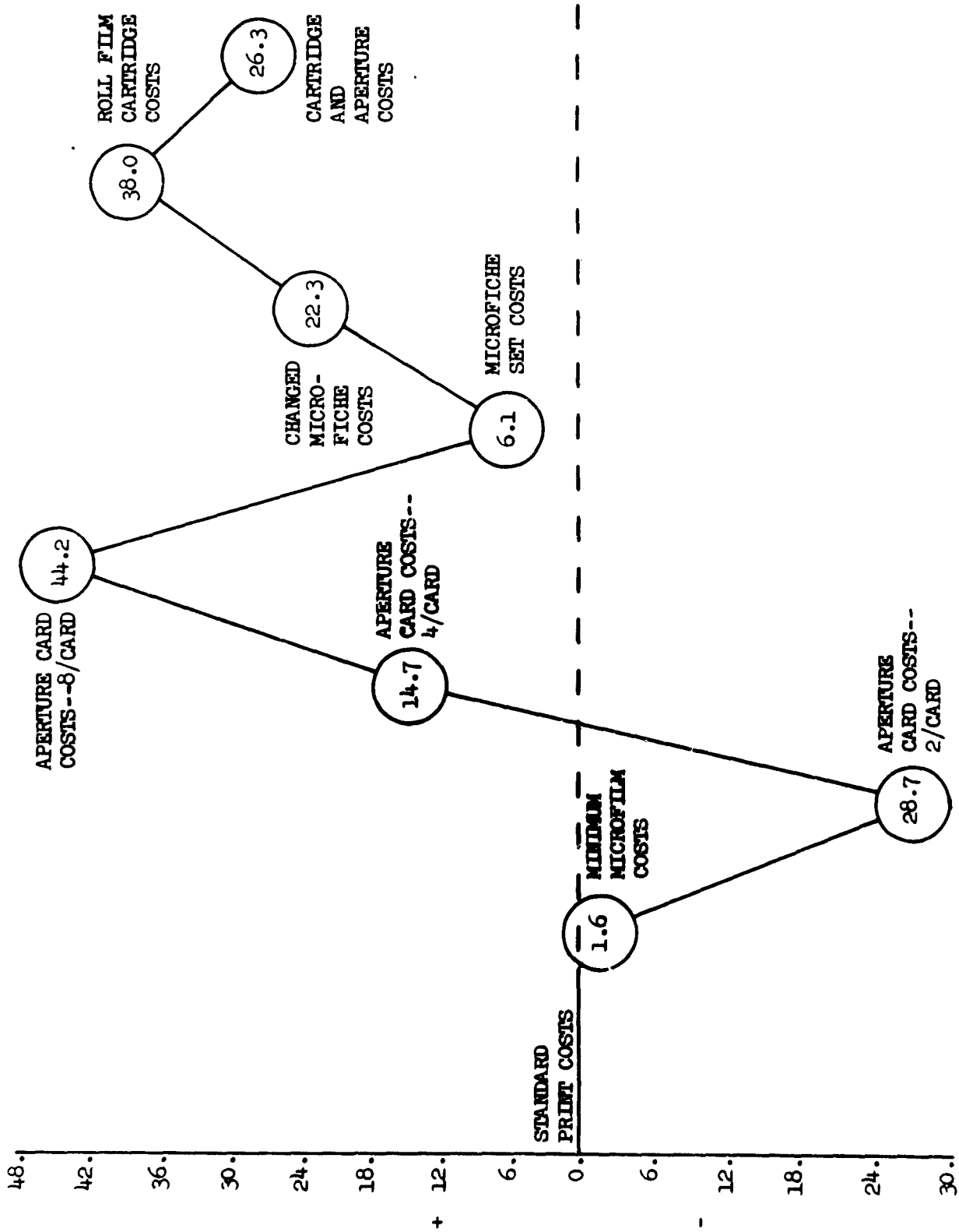FIGURE 1.   COMPARISON AS PERCENT OF STANDARD PRINT COSTS

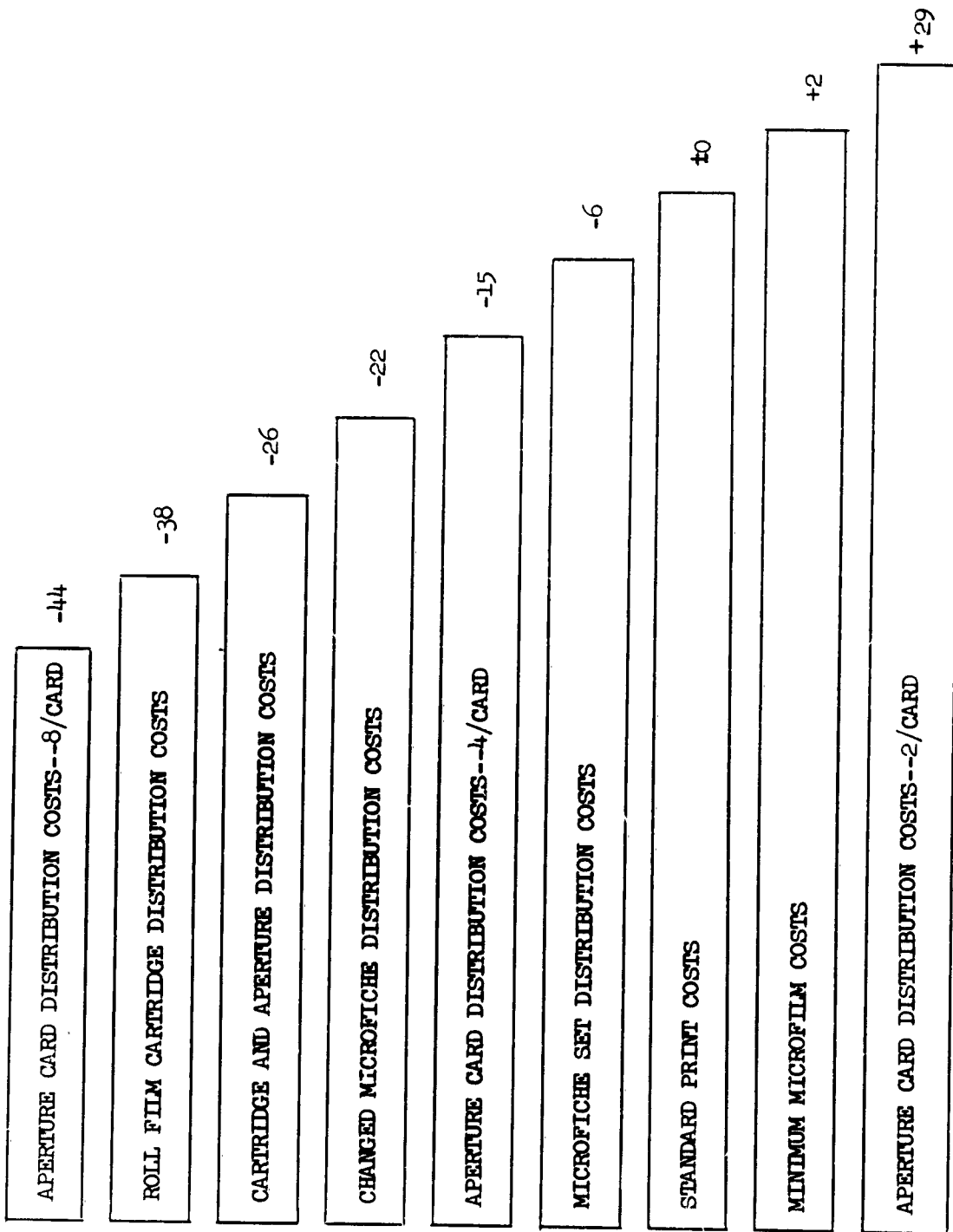FIGURE 2. PERCENT SAVINGS ON STANDARD PRINT COSTS

FIGURE 3. RANKING OF METHODS BY COST SAVINGS

The following data appears as a horizontal bar chart:

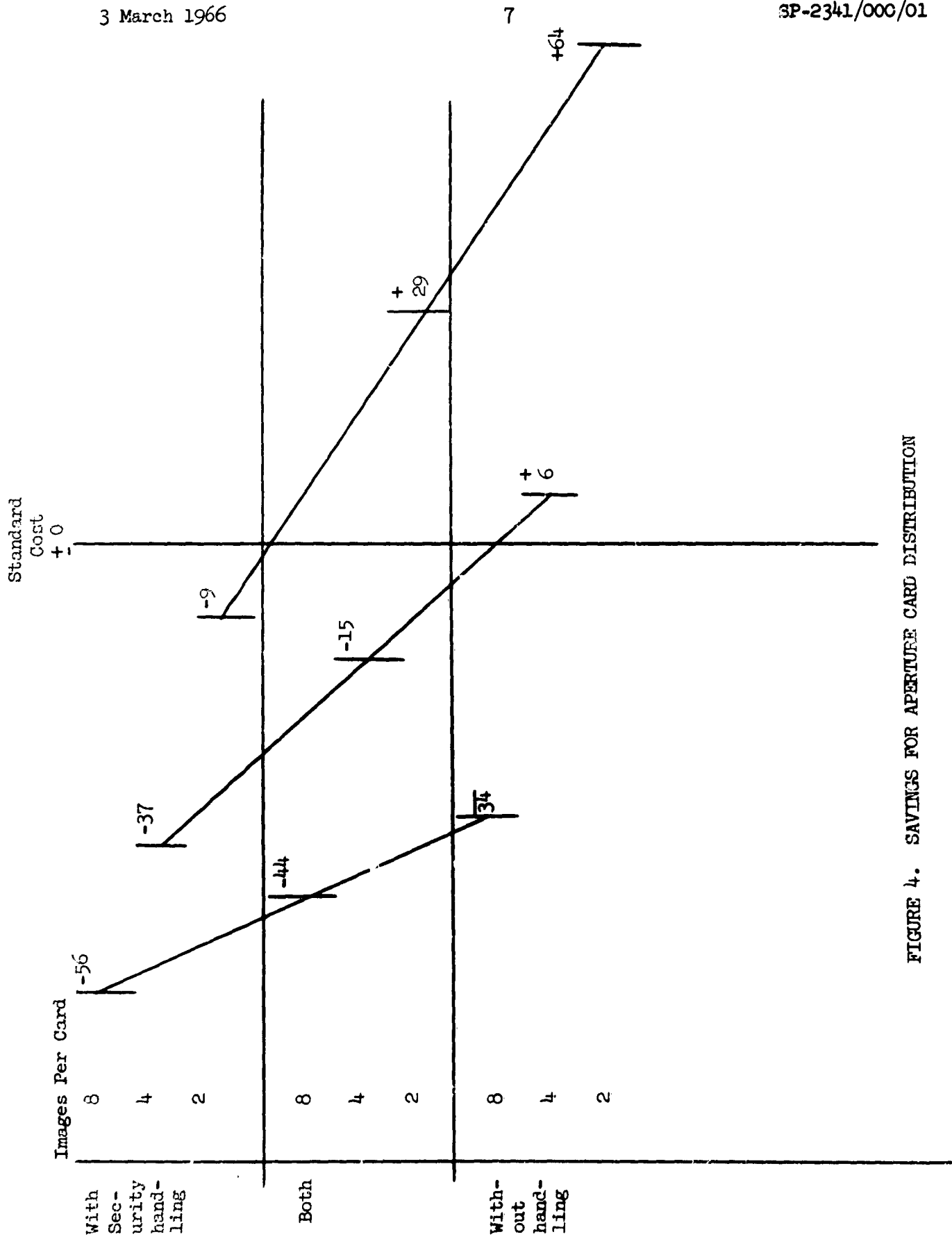| Method	Cost Savings
APERTURE CARD DISTRIBUTION COSTS--8/CARD	-44
ROLL FILM CARTRIDGE DISTRIBUTION COSTS	-38
CARTRIDGE AND APERTURE DISTRIBUTION COSTS	-26
CHANGED MICROFICHE DISTRIBUTION COSTS	-22
APERTURE CARD DISTRIBUTION COSTS--4/CARD	-15
MICROFICHE SET DISTRIBUTION COSTS	-6
STANDARD PRINT COSTS	0
MINIMUM MICROFILM COSTS	+2
APERTURE CARD DISTRIBUTION COSTS--2/CARD	+29

FIGURE 4. SAVINGS FOR APERTURE CARD DISTRIBUTION

The formulas are presented in Appendix A. The value for each term specified in the formulas is presented in Appendix B. To help understand how best to use these formulas, let us examine and comment on two of them.

STANDARD PRINT METHOD

The standard print method is based on use of a page of camera-ready copy, the transfer of that page image to a multimaster, and the printing of that page on a multilith press. The end product is a set of printed pages that is available for distribution, that is, distribution is 100% paper.

The standard print cost is determined by the following formula:

$$C = M_1 P + IPD + SD$$

where:

C = standard print cost in dollars.

M_1 = cost for generating a multimaster from a camera-ready page.

P = the number of pages to be printed.

I = the cost for printing one side of a piece of paper, including the cost of the paper, collating a set of papers, and fastening the pages together.

D = the number of copies required for distribution.

S = special handling charges, including, in our case, the cost for controlling, recording, and destroying classified documents, and for the differences in handling and distributing classified documents.

We have the three common elements of cost defined in this formula--the cost for platemaking $(M_1 P)$, the cost for printing paper copies (IPD), and the cost for handling and distribution (SD).

The cost for generating a multimaster from a camera-ready page varies with the type of process used. If the page is photographed and a metal offset plate is made from the negative, the cost could run as high as $2.50 per page. If the page is fed through a Xerox 914 Copier, using a short-run paper master, the cost might be 25 cents per page.

The cost per impression has its variables, as well. The paper may cost only .2 of a cent for one grade, or, perhaps, 10 cents for another grade. Make-ready time on the press may have to be charged against 100 sheets of paper in one job, and 10,000 sheets of paper on another job. The collation of three pages is less expensive than the collation of 34 pages. Stapling a set of pages costs, say, $10 per thousand sets of pages. Using a plastic spiral binder, on the other hand, may cost $250 per thousand.

Special handling charges likewise have a wide range of values, depending on the methods for shipping, for example. The difference in distribution costs involved with airmail special delivery for overseas shipment, as compared to fourth class mail, can be substantial. The differences between handling classified and unclassified documents are very great. Some estimates have placed the cost per document for security handling at as much as $45 per document, with an unclassified document of the same type costing only about 37 cents.

With the variations in techniques that can be introduced in platemaking, in printing, in binding, and in distribution, the standard print cost is obviously not very standard, except within a company and when applied to a particular set of books. The formula presented above for determining standard print costs can, however, be used by an organization by substituting the appropriate values as determined by that organization.

MINIMUM MICROFILM APPROACH

In the minimum microfilm approach, the end product is the same as the standard print method, that is, printed pages. But the minimum microfilm approach uses an aperture card as the original copy from which the multimaster is made. This technique is used when the reproduction master is required immediately for a subsequent change, as it is at SDC, or when it is inconvenient to supply the reproduction master to the platemaking facility. I can think of two reasons for inconvenience: (1) when you can find someone else to pay the print bill by supplying only microfilm, or, (2) if you were on the Island of Pago Pago, you film the camera-ready copy, and send the film on to, say, Los Angeles, where a vendor makes the plates and does the printing for you.

The formula for determining the costs when using an aperture card as the original copy for the multimaster is essentially the same as for standard print costs. It includes a platemaking cost, the cost for printing the paper copies, and the cost for distributing the copies. But we now add the cost for generating a negative silver halide film and mounting it in a tab card.

And so it goes. To the negative aperture card cost, just add duplicate aperture card costs and the additional distribution costs, and you have the next formula. These formulas can also be used in forecasting printing and distribution costs for next year's budget, for new contracts, for proposals, and for changes in system requirements.

The methods described here for cost analysis do not account for every cost element and consideration required to decide which of several methods should be selected for reproduction and dissemination of information. However, the use of these formulas should help considerably in reaching the right decision for a particular set of documents.

APPENDIX A

COST ANALYSIS FORMULAS

1. STANDARD PRINT COSTS

Standard Print Costs equals the platemaking cost plus paper copy print cost
plus special handling costs.

$$C = M_1P + IPD + SD$$

where:

C = standard print cost in dollars.

M_1 = cost for generating a multimaster from a camera-ready page.

P = the number of pages to be printed.

I = the cost for printing one side of a piece of paper, includ-
ing the cost of the paper, collating a set of papers, and
fastening the pages together.

D = the number of copies required for distribution.

S = special handling charges, including the cost for controlling,
recording, and destroying classified documents, and for the
differences in handling and distributing classified documents.

For discussion of the variables listed, refer to page 9.

2. MINIMUM MICROFILM COSTS

Minimum Microfilm Costs equals the platemaking cost plus paper copy print cost
plus special handling costs plus aperture card cost.

$$A = M_2P + IPD + SD + a_1P$$

where:

A = the minimum microfilm cost.

M_2 = the cost for generating a multimaster from an aperture card.

P = the number of pages to be printed.

I = the cost per impression (the cost for printing one side of a piece of paper, etc.)

D = the number of copies required for distribution.

S = special handling charges.

a_1 = the cost to generate a negative silver halide film and mount it in a tab card.

For discussion of the variables listed, refer to page 9.

3. APERTURE CARD DISTRIBUTION COSTS

Aperture Card Distribution Costs equals platemaking cost plus paper copy print cost plus special handling costs plus master aperture card cost plus duplicate aperture card costs.

$$B = M_2P + .25IPD + S \left(.25D + \frac{D_a}{Q}\right) + \frac{P}{Q} \cdot a_2 + \frac{\cdot}{Q} \cdot a_3 D_a$$

where:

B = aperture card distribution cost.

M_2 = cost for generating a multimaster from an aperture card.

P = number of pages to be printed.

I = impression cost.

D = number of copies required for distribution.

S = special handling costs.

D_a = number of sets of aperture cards to be distributed.

Q = number of page images per aperture card.

a_2 = the cost to shoot and develop a strip of 35mm roll film and to mount a frame of that film into a tab card.

a_3 = the cost to make a direct contact duplicate aperture card from the master aperture card.

The number of sets of aperture cards to be distributed can be expressed as a single number or can be expressed as a percent of the number of copies required to distribute paper copies only. The number of aperture cards required is a function of the number of page images per card.

Special handling charges should be essentially the same, whether paper copies or aperture cards are used, unless mailing costs are included in the special handling charges. In that case, the special handling costs can be determined as follows:

$$.25D \cdot S_1 + \frac{D_a}{Q} \cdot S_2$$

where S_1 represents the cost for distributing paper copies and S_2 represents the cost for distributing a set of aperture cards.

4. MICROFICHE SET DISTRIBUTION COSTS

Microfiche Set Distribution Costs equals platemaking costs plus paper copy print cost plus special handling costs plus master microfiche costs plus duplicate microfiche costs.

$$E = M_3 P + .25IPD + S(.25D + D_F) + F_1 \left(\frac{P_{c_1}}{v} + \frac{P_{c_2}}{v} + \dots \frac{P_{c_n}}{v} \right)$$

$$+ D_F F_2 \left(\frac{P_{f_1}}{v} + \frac{P_{f_2}}{v} + \dots \frac{P_{f_n}}{v} \right)$$

where:

E = microfiche set distribution cost

M_3 = cost for generating a multimaster from microfiche

P = number of pages to be published.

I = cost per impression.

D = number of paper copies required.

S = special handling costs.

D_F = number of sets of microfiche to be distributed.

F_1 = cost for making a microfiche master.

P_c = number of pages in a part/chapter in which one or more pages are changing.

v = number of page images per microfiche.

F_2 = cost for making a duplicate microfiche.

P_f = number of pages in a part/chapter.

In this costing, we provide a microfiche copy of the smallest book division employed, in our case, either part or chapter. We provide a complete set of microfiche covering all documents in the series of books, whether the fiche has been changed or not. To determine the number of new microfiche masters required as a result of pages being changed, we must first determine the number of pages in the part or chapter having one or more pages, and then divide by the number of images per fiche. For duplicate fiche, we must determine the number of pages in each part/chapter, and then divide that by the number of images per fiche, since we are distributing a totally new set of fiche to holders of previous sets of fiche.

The same comments apply to special handling charges for microfiche that apply to aperture card distribution.

5. CHANGED MICROFICHE DISTRIBUTION COSTS

Changed Microfiche Distribution Costs equals platemaking costs plus paper print costs plus special handling costs plus master microfiche costs plus duplicate microfiche costs.

This formula is identical to Formula 4, the Microfiche Set Distribution Cost formula, except for the cost of duplicate microfiche. To determine the cost of duplicate microfiche when distributing only duplicates of changed microfiche masters, substitute the following:

$$D_F F_2 \left(\frac{P_{c_1}}{v} + \frac{P_{c_2}}{v} + \ldots \frac{P_{c_n}}{v} \right)$$

in place of the equivalent expression, in which P_f has been used.

Sound control practices may dictate that all microfiche be replaced when any one is changed, rather than replacing only the changed fiche. Some elements to consider in addition to cost includes:

    a. Number of people using the file.
    b. Number of sets of files.
    c. Number of fiche in file.
    d. Security classification of information.
    e. Effect of improper purging of obsolete material.
    f. Familiarity of users of information with or identification of updated information.

6. ROLL FILM CARTRIDGE DISTRIBUTION COSTS

Roll Film Cartridge Distribution Costs equals platemaking cost plus paper copy
print cost plus special handling costs plus filming and developing costs plus
duplicate film costs.

$$R = M_3 P + .25IPD + S (.25D + D_R) + F_3 + F_4 D_R$$

where:

R =   roll film cartridge distribution cost.

M_3 =   cost for generating a multimaster from roll film.

P =   number of pages to be printed.

I =   cost per impression.

D =   number of paper copies required.

S =   special handling costs.

F_3 =   cost for exposing and developing a roll of microfilm.

F_4 =   cost for making a duplicate of a roll of film.

D_R =   number of duplicate films to be distributed.

The cost for generation of a multimaster from roll film is usually the same as
for generation using either aperture cards or microfiche, if, in fact, the
available equipment will permit use of that particular microform.

Since a roll of film is assumed to contain 2,000 images, any change to one of
the images costs the same as a change to all 2,000. But, because our books are
not necessarily change each month, we have computed a standard cost per book,
which reflects the frequency of change of that book, and the grouping of books
on a cartridge.

7. CARTRIDGE AND APERTURE CARD DISTRIBUTION COSTS

Cartridge and Aperture Card Distribution Costs equals platemaking cost plus
paper copy print costs plus special handling costs plus roll film generation
costs plus duplicate cartridge costs plus master aperture card cost plus
duplicate aperture card costs.

$$G = M_3 P + .25IPD + S \ (.25D + D_R + D_a) + F_3 + F_4 D_R + \frac{P}{Q} \cdot a_2$$
$$+ \frac{P}{Q} \cdot a_3 D_a$$

Where:

G   =   cost of cartridge and aperture card distribution.

M_3 =   cost for generating a multimaster from roll film.

P   =   number of pages to be published.

I   =   cost per impression.

D   =   number of paper copies to be distributed.

S   =   special handling costs.

D_R =   number of duplicate films to be distributed.

D_a =   number of duplicate aperture card sets to be distributed.

F_3 =   cost for exposing and developing a roll of microfilm.

F_4 =   cost for making a duplicate of a roll of film and mounting
        on cartridge.

Q   =   number of page images per aperture card.

a_2 =   cost for making a master aperture card.

a_3 =   cost to make a duplicate aperture card.

For convenience, we have shown only cartridge, aperture card, and paper dis-
tribution. The formula can also be used to combine distribution of microfiche,
cartridge and aperture card copies, plus the normal distribution of paper
copies. Or, by slight modification, film strips or jackets can be used as one
of the microforms.

APPENDIX B

STANDARD COSTS

The listings below provide standard values that can be substituted in the formulas in Appendix A in lieu of company-specific values. Standard costs represent vendor costs within the Los Angeles area. Where costs are not available from vendors, a representative cost has been supplied. Where there is a range of alternative values, the range is given, and the variance explained briefly.

TERM	DEFINITION	UNIT VALUE	EXPLANATION/REFERENCE
M_1	Camera-ready copy to multimaster	\$2.50 to \$0.25	\$2.50 - neg and metal plate 1.90 - neg and paper plate 0.60 - photodirect paper plate 0.40 - Bruning plate 0.25 - Xerox 914 plate
I	Cost per impression	\$0.02	
S	Special handling	\$1.40	See Note.
a_1	Master aperture card	\$0.13	3M Filmsort 100OD camera card.
M_2	Aperture card to multi-master	\$0.45	Xerox 1824 or Itek Printer.
D_a	Number of sets of aperture cards to be distributed	50% of standard 15% of standard	Assumed distribution reduction with 25% paper copy. Two aperture cards with other microforms.
Q	Number of images per aperture card	2 or 4 or 8	Depends on material and use. Results use each of these values.
a_2	Master aperture card	\$0.20	Roll film, cut up and mounted.

NOTE: Security handling charges involve control, record, and destruction activities, which relate to specific distribution requirements, numbers of classified documents, type of document control system, etc. This value is not directly usable for any other organization.

TERM	DEFINITION	UNIT VALUE	EXPLANATION/REFERENCE
a_3	Duplicate aperture card	$0.06 $0.08	Diazo duplicate Kalvar duplicate
M_3	Roll film to multi-master	$0.40	Xerox Copyflo
D	Number of copies of printed pages to be distributed	THIS IS STANDARD	Assumes no microform distribution.
D_F	Number of sets of microfiche to be distributed	30% of standard	
F_1	Cost for making a microfiche master, using 16mm film	$2.00	This is silver halide roll film, cut up in strips.
F_2	Cost for duplicate microfiche	$0.30	Volume price is lower.
v	Number of page images per microfiche	55	60 is limit per fed spec.
F_3	Cost for making a negative roll film for cartridge	$1.67 to $8.30 per book	Based on SDC documents with frequency of change of 10 times per year. Assume $25.00 per roll for shooting and developing negative film, including cost of handling original material.
F_4	Cost for making a duplicate roll film and mounting in a cartridge	$0.40 to $2.00 per book	Based on same figures as negative film. Dupe rolls, including cartridge, cost approximately $6.50 per roll.
D_R	Number of cartridges to be distributed	25% of standard 15% of standard	Cartridge distribution only. Distribution of several different microforms.

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13. ABSTRACT

This paper describes the results obtained from analyzing past printing requirements at System Development Corporation and determining alternative methods of printing, duplication, and distribution. The techniques used in determining the costs for each of the several alternative methods are described, and elements of cost discussed briefly. The techniques permit comparisons between standard offset printing methods and conventional distribution methods--aperture cards, microfiche and microfilm cartridges.

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