COSTS OF LIBRARY CATALOG CARDS PRODUCED BY COMPUTER

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Production costs of 79,831 cards are analyzed. Cards were produced by four variants of the Columbia-Harvard-Yale procedure employing an IBM 870 Document Writer and an IBM 1401 computer. Costs per card ranged from 8.8 to 9.8 cents for completed cards.

Early in September, 1964, the Yale Medical Library put into routine operation the Columbia-Harvard-Yale computerized technique for catalog card manufacture (1), and during the following three years Yale produced over 87,000 cards. The principal objective of the CHY project was an on-line, computerized, bibliographic information retrieval system. However, the route selected for attaining the objective included manufacture of cards from machine readable data to keep up the manual catalog while machine readable records were being inexpensively accumulated for computerized subject retrieval. Catalog cards were only one product of the system, but their production was designed to be as efficient as possible within constraints of the system. Nevertheless, this paper will examine CHY card production costs as though this segment of the system were an isolated procedure, yielding but one product, as is the case in classical library procedures. Costing will disregard other benefits, such as accession lists and machine readable data produced for little, or no, additional expense.

The Columbia Medical Library and Harvard Medical Library also installed IBM 870 Document Writers and tested the programs for card production, but neither library routinely produced cards. However, Co-

lumbia produced its acquisitions lists until October, 1966, using CHY techniques. Harvard issued a similar list, but for a shorter period of time, and it was Harvard's withdrawal early in 1966 that brought about the collapse of the project. Nevertheless, other institutions adopted the CHY procedure for catalog card production, among them the Medical Library at the University of Rochester, which used the programs for two years following February, 1966. E. R. Squibb & Sons at East Brunswick, New Jersey, also uses the programs. At the University of Kentucky an 870 Document Writer types catalog cards, but new programs were written to run on an IBM 7040 computer that recently have been recoded in COBOL for an IBM 360/50. Similarly, the Library at Philip Morris, Inc., Richmond, Virginia, rewrote the programs to run on an IBM 1620 computer which punches cards that drive an 870. The Korean Social Science Bibliography Project of the Human Relations Area Files has elaborated the CHY technique into its Automated Bibliographic System (2), which in turn is the base for another bibliographic system for African studies. The machine readable cataloging record of the CHY mechanized system eventually became the great-grandfather of the MARC II format and contributed about as much to MARC II as would have been the case had their relationship been truly biological.

Although the Columbia-Harvard-Yale Project never did develop and activate its proposed bibliographic information retrieval system, R. K. Summit working entirely independently has brought into successful operation his excellent DIALOG system (3) which is essentially the system that CHY had in design stage. Moreover, Summit's system is definitely superior because it has several useful functions not contemplated in CHY.

Nearly all reports on catalog card production limit study of costs to reproduction of cards and neglect other costs involved in preparing cards for the catalog. An exception is P. J. Fasana's 1963 investigation wherein he found that Library of Congress cards, in seven copies and ready to be filed into a catalog, cost 16.6 cents per card; cards produced by a machine method consisting of a tape typewriter and a very small special purpose computer cost 9.9 cents (4). Fasana used an hourly salary rate of $2.00. A study of early experience with CHY production yielded 12.5 cents per card (1) whereas the present study shows that costs range between 8.8 and 9.8 cents per card, cards being in completed form, arranged in packs for individual catalogs, and ready for bursting before alphabetizing for filing.

METHODS

During the course of the three years in which the CHY programs were in operation, four variant techniques were used for card production. The first three with their limitations have been described elsewhere (5). Briefly, the initial system consisted of keypunching from worksheets, listing the punch cards on an IBM 870 Document Writer, proofreading and

correcting, processing the proofread and corrected punch cards on an IBM 1401 computer which produced punch card output that, in turn, was used to drive the 870 Document Writer for production of catalog cards on one-up forms. In the next arrangement, printing of cards on one-up forms was accomplished on an IBM 1401 computer driving an upper- and lower-case print chain. In the third procedure, a two-up card form replaced the one-up form. Finally, the Medical Library returned the 870 Document Writer to the manufacturer, and the 1401 was programmed to do the prooflisting in upper and lower case. The Yale Bibliographic System (6) replaced the CHY routines on 25 July 1967.

The keypuncher kept time records for the various activities listed in Table 1 throughout the period of this study. During the first two months of operation, design for recording data was inadequate. Subsequently an individual would, albeit infrequently, fail to record time elapsed, so that production of 7,630 cards was omitted from the study, leaving a total of 79,831 to be included. On several occasions during the fourth part of the study, the second proofreading was suspended, and only correction carried out. Hence, time expended in this category is less than in the previous three periods. At first an IBM 1401 computer in the Yale Computer Center was used, the Center being located about a mile from the Medical Library. Subsequently, another 1401 modified to drive an upper- and lower-case print chain and located in the Medical School was employed. Later this machine was transferred to the Administrative Data Systems Computer Center, which moved to a new location not long after it assumed operation of the 1401. Still later, the 1401 was again transferred, this time to the Yale Computer Center. As can be seen from the computer charges in Table 1, these wanderings about New Haven appear to have had no effect on operating efficiency. Time recorded for each computer run was actual time clocked by the operator. Other times were recorded by the individual performing the operation.

Salaries used in the cost calculation were salaries being paid in June, 1967, which were, of course, appreciably higher than those in the autumn of 1964; hourly rate for the first proofreader in Table 1 was $2.62 and for the second $2.21. Hourly rental for the 870 Document Writer was $.78. Rate of computer charges employed in the calculation was $20 per hour, a rate that had existed during the last year or so during which data was collected. Initially, computer charges had been $75 an hour, but they dropped precipitously during the first two years. Costs for catalog card stock were the lowest cost charged for the two types of forms. Since these forms were not standard items during the years of the study, their prices varied considerably depending upon the amount ordered.

RESULTS

Table 1 contains cost figures for catalog card production by the four variant techniques. Since salaries and computer charges can vary widely,

Table 1. Per-Card Costs of Computer-Produced Catalog Cards.

	One-up Form on 870		One-up Form on 1401, Proof on 870		Two-up Form on 1401, Proof on 870		Two-up Form on 1401, Proof on 1401	
	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours
Keypunching	.0219	.0099	.0218	.0099	.0222	.0101	.0235	.0106
Keypunch	.0029	.0099	.0030	.0099	.0030	.0101	.0032	.0106
IBM 870-proof	.0033	.0043	.0036	.0046	.0039	.0051		
IBM 1401-proof							.0091	.0046
Proofreaders (2)								
Proofreading	.0115	.0044	.0113	.0043	.0118	.0045	.0116	.0044
Proofreading and correcting	.0120	.0055	.0122	.0055	.0119	.0054	.0091	.0041
IBM 1401	.0149	.0085	.0313	.0156	.0231	.0116	.0245	.0112
IBM 870-card typing	.0104							
Card Stock	.0149		.0149		.0125		.0125	
TOTAL	.0918		.0981		.0884		.0935	
Number of Cards	15,149		9343		27,210		28,129	
Number of Titles	1,655		990		2,920		3,130	
Cards per Title	9.2		9.4		9.3		9.0	

particularly among countries, time per card produced is also included in the Table to facilitate comparison with other systems. Of course, amounts of time calculated by dividing elapsed time by amount of product are not directly comparable with results of time and motion studies such as Henry Voos' helpful study (7). However, two different methods of comparing the input costs in Table 1 with those Johnson (8) published for the Stanford book catalog gave divergences of only 2 and 6 per cent.

Source of the increase in costs of six-tenths of a cent from the first procedure to the second is entirely the increase in computer charges when the 1401 replaced the 870 to print cards. When the two-up form was employed on the computer in variant three, charges then dropped to less than the combined 1401 and 870 costs in the first procedure. Costs rose again in procedure four. Here the principal cause of the increase was the substitution of computer-produced proof listings after the 870 Document Writer had been returned to the manufacturer.

Although there is no reason to think that preparation of cataloging copy on a worksheet is either more or less expensive than older techniques, coding a worksheet constitutes additional work for which there is no equivalent in classical procedures. Coding costs were examined between 9 March and 11 May 1965, when six individuals, ranging from professional catalogers to a student assistant, recorded time required to code 725 worksheets. Time per final catalog card produced was three seconds; in other words, \$.003 for a cataloger receiving \$7500 a year, or \$.001 for a student assistant earning \$1.50 an hour. If total coding cost, rather than a portion of it, were to be charged to card production, costs reported in Table 1 could rise one- to three-tenths cents.

DISCUSSION

The accurate comparison of costs would be with those of systems similar to the CHY system that produce more than one product. For instance, the CHY system also produced monthly accession lists from the same punch-card decklets that produced catalog cards. The accession list was produced mechanically at a cost far less than that for the previous manual preparation. The decklets also constituted machine readable information available for other purposes, most of which have not yet been realized. System costing would assign only a portion of keypunching and proofreading costs to card production.

Another saving was the appreciable shortening of time required for catalog cards to appear in the catalog. In procedures one through three, usually three or four days elapsed from the day on which the cataloger completed cataloging to the day on which cards were filed into the catalog. However, in procedure four, the computer, which was then a mile distant from the Medical Library, was used on two separate occasions for each batch of decklets, so that elapsed time rose to at least a week.

Even though other benefits are not reflected in comparative costs, it is clear from Fasana's findings that the CHY computer-produced cards cost far less than do LC cards, and have a similar cost to those produced mechanically on which Fasana reported. Although there appears to be no published evidence that photocopying techniques can produce finished catalog cards at less expense than 9 cents, it is possible that some photo-reproduced cards may be less expensive than those described in this article. However, it must be pointed out that photo-reproduced cards are products of single-product procedures, whereas the CHY cards are one of several system products.

Increase in cost between procedure three and procedure four was due to increase in cost of prooflisting in upper and lower case on the 1401 computer as compared to prooflisting on the 870 Document Writer. This cost increase was not detected until calculations were done for this investigation, and therein lies a moral.

It was the policy at the Yale Library for all programming to be done by library programmers, since various inefficiences, and indeed catastrophes, had occasionally been observed when non-library personnel had prepared programs for library operations. The single exception to this policy was the proof program, which this investigation reveals used an exhorbitant amount of time—one-third of that required for subsequent card production. Since it had been felt that writing and coding a prooflisting program was perfectly straightforward, an outside programmer of recognized ability was employed to write and code the program. Because the program was simple, and because the programmer had high competence, efficiency of the program was never checked as it should have been.

This episode raises the question that if even the wary can be trapped, how can the unwary avoid pitfalls? There is no satisfactory answer, but it would appear that some difficulties could be avoided by review of new programs by experienced library programmers, of which there are unfortunately far too few. Comparison with data such as that in Table 1 will also be helpful, but not definitive, in evaluating new programs. Of course, when widely used library computer programs of recognized efficiency are generally available, magnitude of the pitfalls will have been greatly reduced.

CONCLUSION

Computer-produced catalog cards, even when they are but one of several system products, can be prepared in finished form for a local catalog less expensively and with less delay than can Library of Congress printed cards. Computer card production at 8.8 to 9.8 cents per completed card appears to be competitive with other procedures for preparing catalog cards. However, undetected inefficiency in a minor program increased costs, thereby emphasizing need to insure efficiency in programs used routinely.

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