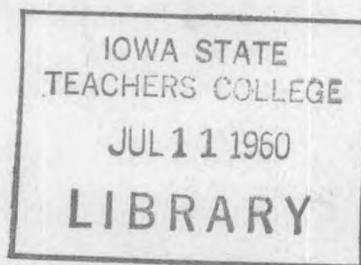


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Adjustments to the Introduction of Office Automation



A study of some implications of the installation of electronic data processing in 20 offices in private industry, with special reference to older workers.

Bulletin No. 1276

UNITED STATES DEPARTMENT OF LABOR

James P. Mitchell, Secretary

BUREAU OF LABOR STATISTICS

Ewan Clague, Commissioner



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PREFACE

The introduction of electronic data processing has brought concern over the problems of employee adjustment to this innovation, although it is widely recognized that continuing productivity gains are essential to the Nation's economic growth. In an attempt to find out what problems are involved and how they are being met, the Bureau of Labor Statistics undertook a study of 20 offices which had installed large-scale electronic computers for processing business data. The study was undertaken as part of the Bureau's research on the economic and social implications of important technological developments.

The study was made in the Bureau's Division of Productivity and Technological Developments under the general direction of Leon Greenberg, Chief. Edgar Weinberg directed the study and wrote the report. Herman Rothberg, Stanley Miller, Richard Riche, and Bennett Moss, assisted by Gretchen Mann and Edward Jakubauskas, made the detailed field interviews.

The study could not have been accomplished without the generous cooperation of the officials of the companies and unions visited. The Bureau is indebted to them for their contributions of time and effort.

CONTENTS

	<u>Page</u>
Chapter I.	Introduction..... 1
	Implications for a Changing Labor Force..... 1
	Objectives of Study..... 2
Chapter II.	Summary and Conclusions..... 3
	Management Objectives..... 3
	Personnel Planning for Transition..... 3
	Extent of Displacement and Reassignment..... 3
	Effect on Growth of Office Employment..... 4
	Creation of New Jobs..... 4
	Change in Grade Structure..... 5
	Selecting and Training Employees..... 5
	Some Problems of the Changeover..... 5
	Implications for Older Employees..... 6
Chapter III.	Scope of Study..... 7
	Coverage of the Survey..... 7
	Limitations of the Survey..... 8
Chapter IV.	Applications, Objectives, and Achievements of Electronic Data Processing..... 9
	Application of Electronic Data Processing..... 9
	Company Objectives..... 10
	Achievements of Electronic Data Processing..... 11
Chapter V.	Planning in Introducing Electronic Data Processing..... 14
	Intensive Study Phase..... 14
	Planning and Preparing for Computer Applications..... 15
	Installation and Testing..... 15
	Normal Operation..... 15
Chapter VI.	Informing Employees About Change..... 17
	Methods Used in Informing Employees..... 17
	Information Given..... 17
	Union Contract Provisions..... 20
	Attitudes of Unions..... 21
Chapter VII.	Displacement, Reassignment, and Retraining..... 22
	Procedures for Avoiding Displacement..... 22
	Reassignment Practices..... 22
	Retraining..... 27
	Some Problems of Reassignment..... 28
Chapter VIII.	Changes in Employment and Occupational Status..... 30
	Method Used in Study..... 30
	Employment, Displacement, and Turnover in Affected Units..... 31
	Extent of Reassignment, Upgrading, and Downgrading..... 33
	Changes in Type of Occupation..... 34
	Changes in Total Office Employment..... 36

CONTENTS--Continued

	<u>Page</u>
Chapter IX. Organizing Electronic Data Processing.....	38
Number of Positions Required.....	38
Occupational Structure.....	38
Determining Salary and Wage Rates.....	39
Relative Level of Electronic Positions.....	40
Collective Bargaining on Classifications and Rates...	41
Selecting Employees for Electronic Data Processing...	42
Selection Procedures Under Union Agreements.....	42
Testing Applicants for Electronic Data Processing....	45
Training Programs.....	47
Some Problems of Organizing Electronic Data Processing.....	51
Chapter X. Characteristics of Employees in Electronic Data Processing.....	52
Sex and Age of Employees.....	52
Educational Attainment.....	52
Previous Work Experience.....	55
Extent of Upgrading.....	55
Chapter XI. Implications for Older Office Employees.....	58
Employee Traits Required.....	58
Opinions of Personnel Officials.....	61
Findings of Research Workers.....	62
Summary Evaluation.....	64

TABLES

1. Management's objectives in introducing electronic data processing, by order of importance.....	10
2. Management communication with employees about changes.....	18
3. Practices reported in reassigning and separating employees.....	23
4. Job status of employees of the affected units 1 year after intro- duction of electronic data processing, selected age group.....	32
5. Grade status of employees in affected units 1 year after installation of electronic computers, by age.....	34
6. Percentage distribution of employees in affected units, by occupational classification, 1 year after computer installation...	35
7. Methods of selecting employees for electronic data-processing positions.....	43
8. Training programs for electronic data processing positions.....	48
9. Employees in affected units and in electronic data processing positions by age and sex.....	53
10. Educational level of employees in affected units and in electronic data processing.....	54
11. Occupational classification of employees in electronic data- processing positions by prior occupational classification.....	56

TABLES--Continued

	<u>Page</u>
12. Grade status of employees in electronic data-processing positions after transfer from other office units, by age.....	57
13. Employee traits desired for positions in electronic data processing.....	60

APPENDIXES

A. Unemployment rates, 1954-59.....	65
B. Provisions of union contract relating to reassignment of physically impaired employees.....	66
C. Excerpt from International Labor Organization Report.....	67
D. Reassignment procedures and time schedule followed in a large insurance company.....	70
E. Principles established by a large insurance company to guide the reassignment of employees affected by electronic data processing...	72
F. Titles used and duties of six types of electronic data processing positions at companies studied.....	74
G. Provisions of union contracts relating to the setting of wage rates for new positions in electronic data processing.....	76
H. Steps followed in one large company in selecting employees for electronic data-processing positions.....	78
I. List of tests used by companies in selecting employees for electronic data-processing positions.....	80
J. Selected annotated bibliography.....	81

ADJUSTMENTS TO THE INTRODUCTION OF OFFICE AUTOMATION

Chapter I. Introduction

The growing use in modern offices of electronic computers is one of the most important recent trends in American technology. The past decade (1950-60) saw a steady increase in the use of improved mechanical and electrical devices for all types of office work, but electronic computers or data processing machines, with their vastly greater speed, more compact filing capacity, and more continuous operation, represent dramatic advances. Developed as part of the post-World War II expansion of scientific and engineering research, the computer is often regarded as a symbol of the more complicated technology now emerging in our industrial life.

First introduced in 1946, electronic computers are being used on an increasingly wider scale in offices and plants with a large volume of routine paperwork. The computers were first used in making the long arithmetical calculations necessary in preparing ballistic tables, in carrying out various engineering tasks, and in conducting scientific research. A pioneering step in their use on large-scale clerical tasks was the processing of data from the 1950 Census of Population. By early 1959, an estimated 2,000 electronic computers of all sizes were being used for a variety of business, scientific, and engineering purposes, by private companies and government agencies.

The future will probably see electronic data processing equipment diversified in design, improved in performance and reliability, and extended to many types of activities. The rate of introduction will no doubt depend on a host of complex economic, administrative, and social factors including the reactions of office employees themselves to the changes.

Implications for a Changing Labor Force

These innovations imply important changes in employment for the broad class of employees engaged in clerical occupations. In this group are file clerks, bookkeepers, office machine operators, cashiers, typists, and many others engaged in various types of data processing.

About 9.6 million persons were employed as clerical workers in February 1960, representing about 1 of every 7 workers in the United States. Thus far, employment in clerical occupations has been growing at a faster rate than the labor force, with the proportion of employees in clerical jobs rising from 1 in 20 in 1910 to 1 in 8 in 1950. Clerical employment is still increasing at a faster rate than the workforce as a whole, though the rate of increase is somewhat slower than in the past. ^{1/} Unemployment among clerical workers has

^{1/} See Automation and Employment Opportunities for Office Workers. BLS Bull. 1241 (1958).

been relatively low. The unemployment rate averaged 3.7 percent in 1959, compared to 5.5 percent for the civilian labor force. (See appendix A.) The rate has declined from the 1958 rate, the highest of recent years, but is still higher than it was in the 1954-57 period.

At the same time that electronic data processing and other technological advances are modifying clerical job requirements, office administrators, union officials, and others will be increasingly concerned with the employment problems of older workers. About 5.5 million of the 13.5 million increase in the labor force expected in the 1960-70 period will come from persons 45 years of age and over with especially sharp increases among women in this age group.

Although it is difficult to estimate the proportion of all clerical employees who are employed in positions or offices where electronic data processing would be economically feasible, the trend toward the use of more data processing equipment is expected to have a widespread impact. Some people fear that many office employees may be adversely affected because of displacement and downgrading of skills; others are hopeful that the new technology will bring substantial benefits and new opportunities.

Objectives of Study

The study covered a variety of subjects: the objectives and results of electronic data processing; the extent of displacement and reassignment of office employees; the practices regarding transferring, retraining, and selecting employees for new occupations; the characteristics of employees whose jobs are eliminated and who were assigned to new positions; and some of the implications of office automation for middle-aged and older employees.

An account of the procedures that some offices used in planning and effecting changes may suggest to management and employee organizations measures that might be useful elsewhere.

Chapter II. Summary and Conclusions

The major findings of the study are summarized in this chapter. These conclusions are based on information collected from 20 offices that had installed large-scale electronic data processing equipment for business purposes.

Management Objectives

The introduction of a large-scale electronic computer increased data-processing capacity and provided a means of achieving significant operating savings on a variety of large-scale routine activities such as payroll preparation and billing. These savings generally resulted not only in a larger clerical output with the same or fewer employees--a major objective--but also economies in processing time, space, and equipment, and greater accuracy. Moreover, some offices were able to process data for management decisionmaking that were previously uneconomical to collect. This new information increased the clerical workload. But, by extending management's control over inventory, other operations and conditions, the acquisition of such data also opened up the possibility of achieving savings in nonclerical activities.

Personnel Planning for Transition

The installation of a new computer involved a sequence of administrative, technical, and personnel changes that, on the average, spanned nearly 3 years. This long preparatory period was particularly useful in avoiding extensive dislocation of employees. During this preliminary period, most of the offices studied informed employees about prospective changes, assured those affected of job security, and curtailed hiring to fill vacancies. In the seven offices where employees were organized, existing contracts provided machinery for employee notification and the application of seniority rules in displacement and transfer. A few of the contracts contained provisions regarding consultation, training, and severance benefits.

Extent of Displacement and Reassignment

Within 1 year after the installation of the computer, about one-third of the approximately 2,800 employees in units whose work was directly affected had been reassigned to other positions, either within the same unit or elsewhere in the office. A majority remained in the same position. Close to one-sixth had quit, retired, died, or had taken leave of absence. Only 9 persons had been laid off. Altogether, employment in the affected unit had been reduced by about 25 percent at the end of the year.

A little over 80 percent of the employees affected by the change were in jobs involving posting, checking and maintaining records, filing, computing, or tabulating, keypunch, and related machine operations. Most of the remainder were in administrative, supervisory, and accounting work. Only a little over 4 percent were engaged in the less routine clerical jobs such as correspondence, stenographic, and secretarial work.

About two-thirds of those workers still employed in the offices 1 year after the installation continued to do the same type of work. Only about 16 percent of this group were shifted to a different type of work, e.g., from posting and checking to computing. A little under 2 percent, a total of 52 persons, most of whom had been doing administrative, accounting, or tabulating machine work, were transferred from the affected group to electronic data processing jobs.

Close to one-third of the employees in the affected group had been promoted to a higher grade. A negligible number had been downgraded. Most of the upgrading involved employees under age 45 and to some extent reflected promotions which would have taken place regardless of the advent of the new equipment.

The relatively favorable experience of these offices reflected the widespread adoption of policies to provide job security, the continued growth of the clerical workload, and the high rate of labor turnover during a period of prosperity. Since these were large offices, employees could be transferred to comparable clerical positions requiring a relatively short period of on-the-job retraining (with the exception of those assigned to electronic data processing.)

Effect on Growth of Office Employment

In the offices studied, the groups directly affected by the introduction of electronic data processing represented, on the average, only about 5 percent of total office employment. Since the companies planned to apply the computers to other activities a larger proportion of office employees will obviously be affected.

Despite the reduction in labor requirements for the tasks performed by the computers, total employment of the offices as a whole rose. Over the 4 years from December 1953 to December 1957, total office employment at 17 of the offices studied increased an average of 7 percent. This increase, however, was less than the 15-percent rise reported for clerical and kindred workers in the Nation as a whole. In 6 of the 17 offices, the increase was greater than 15 percent; in 7, less; and in 4 there was a decrease. Although the immediate effect of electronic data processing suggests some retardation in the growth of office employment, particularly part-time work, the experience of some offices suggests the possibility of expanding employment in new areas of office activity to handle information which had previously been uneconomical to acquire.

Creation of New Jobs

A small number of new positions were created to operate, program, and manage electronic data-processing activities. An average of 29 persons was employed in these units at the time of the study. Close to 7 out of 10 persons

in electronic data-processing work were in programming and planning positions, about a quarter were engaged in operating the equipment, and 8 percent of the group were in administrative and supervisory positions.

Wage and Salary rates were generally fixed through existing job evaluation and personnel classification systems and, where the employees were organized with the participation of the unions. The offices generally rated these new positions at somewhat higher grades than jobs in other data processing, placing them at the top of the office pay structure.

Change in Grade Structure

The introduction of electronic data processing raised the average grade or skill of office occupations, but only to a slight extent. Routine low paid jobs becoming vacant during the transition period were eliminated, which resulted in the higher paid group making up a larger proportion of the total in the affected group. The classification of electronic data-processing positions at the top of the office pay structure also tended to upgrade the pattern. Since the newly created positions constituted a small proportion of total office employment, however, the net effect on the structure of an entire office was small.

Selecting and Training Employees

More than 80 percent of all employees in the new positions were selected from within the offices. Those hired from the outside were primarily trainees. Of the 915 employees in these new positions, only 52, or close to 6 percent, were selected from among employees whose work had been directly affected. Most offices used standard tests of learning ability and numerical aptitude to screen applicants for these positions but based their selection on individual interviews and appraisal.

Typically, the persons selected for programming and planning work, which accounted for the largest group of new positions, were men between the ages of 25 and 34, who had some college education, and who had been engaged in accounting, procedure analysis, or related work. Few women or older workers were chosen for the newly created positions. Four out of five employees assigned to these positions were upgraded. All offices provided at least 4 or 5 weeks of formal classroom instruction for programmers and on-the-job training for operators of the equipment.

Some Problems of the Changeover

Although layoffs were averted for all those whose jobs were eliminated, reassigning employees and staffing the new positions sometimes involved complex personnel problems. Finding suitable positions for long-service employees, especially supervisors, without disturbing promotion opportunities of other employees, presented difficulties. Partly because of the newness of the field, establishing salary levels for the new jobs and interpreting tests for selecting

staff caused some uncertainty. In unionized offices, there were sometimes prolonged negotiations over which, if any, of the new positions would be within the collective bargaining unit.

Implications for Older Employees

Older employees were affected by changes in job status to a lesser extent than younger workers. They benefited from general policies assuring job security, seniority provisions in union agreements, and similar protective provisions in agreements. However, they were not promoted to the newly created electronic positions to the same extent as were younger workers, nor were they hired as trainees. Their educational qualifications, employer's opinions, and preexisting hiring practices, as well as their own lack of confidence in their learning capacity, were said to be among the factors retarding their advancement. In the few cases in which they were assigned to computer work a sense of responsibility and their maturity and experience were considered important factors in favor of older employees.

In those instances where employers had formed opinions about the inflexibility or lack of adaptability of older workers, the introduction of electronic data processing may have intensified reluctance to hire or promote them. The examples of the successful performance of older employees in these new positions, however, in the offices studied, reinforce the findings of research workers on the variability in learning capacity at all ages and underscore the importance of individual appraisal of employees in this field as in others.

As automation is extended, an important task for those concerned with maintaining opportunities for older workers is to develop a better appreciation of the value of the new job of the older workers' maturity and stability and a better understanding of their capacity to learn new methods.

Chapter III. Scope of Study

Information for the study was collected by BLS representatives through personal visits and interviews with management and union officials who had direct knowledge of the changes. Such information consisted of (1) information, largely nonstatistical, about the personnel policies and practices of offices that have installed electronic data processing systems and (2) statistical data compiled from personnel records.

Coverage of the Survey

The survey was limited to 20 offices in private industry which had been operating large electronic digital computer systems at least one year by mid-1957 for processing business data. Each system, including the main apparatus and various pieces of auxiliary equipment, sells for over \$1 million or rents at over \$25,000 a month. At that time, these offices accounted for more than a half of the companies which were applying electronic data processing systems, on a large scale, to clerical work.

Only offices actually using such computers on a "normal run" or "debugged" basis were covered. The cutoff date of mid-1956 was chosen to assure that the companies in the study would have at least a year's operating experience by mid-1957, when planning of the study was initiated. Of the 20 offices studied, 3 had installed their computers in 1954, 9 in 1955, and 8 in 1956.

The 20 offices in the survey were part of some of the largest corporations in the American economy. Most were in industries that had grown relatively rapid in the past decade--public utilities, air transportation, insurance, chemicals, electrical machinery, and aircraft. Others were in the petroleum refining, steel manufacturing, and railroad industries. Seven were in insurance.

With few exceptions, the computers were installed at the central or home office, the locale of much of the corporation's accounting and recording work. The total number of employees in these offices (based on 17 offices studied) ranged from about 700 to approximately 14,000 and averaged about 4,000.

Most of these offices were located in metropolitan areas of eastern United States; a few were in Midwestern States. According to reports by the local employment service offices, supply and demand for clerical workers in these labor markets at the time the computers were installed were generally in balance, but with some shortages, principally of experienced typists, stenographers, and tabulating machine operators.

These offices had processed data for many years by mechanical tabulating and related punchcard equipment. In only one office did electronic data processing take the place of a more or less manual system. The introduction of electronic computers, therefore, was merely the latest step in a sequence of technological improvement.

Limitations of the Survey

In assessing the findings of this survey, it is important to bear in mind some important limitations. Not all aspects of the subject could be considered in this study and this in itself may suggest areas where research might be undertaken by others.

First, the scope did not extend to all types of users of large electronic digital computers. Government agencies, firms using electronic systems for engineering or scientific purposes only, or for industrial operations, service centers, service bureaus of computer manufacturers, and offices with special purpose computers for airline reservations control and similar uses were excluded. ^{2/} Another group outside the scope of this survey consisted of users of small and medium size computers for business purposes. This group is relatively more numerous than the group using large computers, but the implications of such computers are believed to be similar to those resulting from the impact of large computers. ^{3/}

Second, the experiences on this sample of installations may not be representative of the effects that might be recorded in these offices at a later stage of use.

Third, no attempt was made to collect data on the attitudes of employees and supervisors about the changes in their status, the steps they adopted, etc. ^{4/}

Fourth, the study was concerned only with the immediate implications for employment at the offices visited. Indirect effects on employment trends among factory and technical workers at plants where computers are used or manufactured were not studied. Nor were the possible effects on office employment at competing companies which had not yet adopted electronic computers considered.

^{2/} For the experience of Federal agencies, see Personnel Impact of automation in Federal Service, U.S. Civil Service Commission, Washington, 1957, and Use of Electronic Data Processing Equipment, Hearings before the Subcommittee on Census and Government Statistics of the Committee on Post Office and Civil Service, House of Representatives (86th Cong., 1st Sess.) For a study of the use of a special purpose computer, see A Case Study of an Automatic Airline Reservation System, BLS Report 137 (1958).

^{3/} See study by Charles E. Ginder, Why Automation, National Office Management Association (1959).

^{4/} For studies of the attitudes of office employees to technological changes, see H. F. Craig, Administering of a Conversion to Electronic Accounting, Harvard Business School, Division of Research, Boston, 1955; Jack Steiber, Automation and the White-Collar Worker (in Personnel Magazine, November-December 1957); and Eugene Jacobson, et. al., Employee Attitudes Toward Technological Change in a Medium Sized Insurance Company (in Journal of Applied Psychology, December 1959).

Chapter IV. Applications, Objectives, and Achievements of Electronic Data Processing

Among the first questions that must be considered in assessing the implications of the new office technology are: What applications were made, what were the objectives, and how successful were users in accomplishing their objectives?

Application of Electronic Data Processing

The first applications of the computer were made on large scale, routine, repetitive operations which to a great extent were already performed mechanically. Some examples are payroll preparation, premium billing, calculation of reserve liability, customer billing, revenue accounting, accounts payable and receivable, car accounting, mortgage accounting, inventory control, actuarial calculation, multiple correlation, and dividend calculation.

The applications subsequently made were in somewhat less routine areas of data processing. Following use for payroll preparation, for example, several manufacturing companies utilized their computers for reports on sales, production costs, and market research information. As the scope of application has widened, the capacity of computer installations has been used more intensively. At the time of the survey, 14 companies reported multishift operations. Eight of these companies were on a two-shift basis and six worked three shifts. Because of the large investment involved several companies indicated a strong incentive toward multishift, continuous operation of electronic computers.

Looking forward, many companies reported that they were planning, over the next few years, still other applications which would mean greater utilization of existing capacity and, in some cases, the installation of additional computers. Some typical applications that were being planned were machine loading studies, commission accounting, statistical reports, stockholder records, production scheduling, general accounting, and sales forecasting.

Many plan to extend electronic data processing to mass accounting operations, along the lines already begun. One insurance company executive, for example, predicted at the time of the computer's installation that—

Its use will . . . be extended into new areas through a gradual transition over several years. Ultimately, its applications will cover substantial parts of the routine administration connected with all phases of the company's business.

A few offices were planning to process information, in some cases hitherto unavailable, that would improve management's control and hence the efficiency of their nonclerical operations. For example, one manufacturing company intended to make sales forecasts. Another planned to use electronic

systems to prepare data on machine loading to improve industrial operations. Others planned to apply their computers to inventory control problems.

Company Objectives

The objectives in applying electronic data processing were primarily cost savings from greater productivity, both of labor and capital. Thus, a majority of the offices surveyed ranked clerical laborsavings as their most important objective. (See table 1.) By this, they meant increasing clerical output with the same amount of labor, not necessarily a reduction in office employment.

Table 1. Management's objectives in introducing electronic data processing, by order of importance

Objective	Objectives, by number of companies and order of importance ^{1/}		
	First	Second	Third
Clerical laborsaving.....	11	5	—
Equipment saving.....	4	1	1
Spacesaving.....	2	—	1
Timesaving.....	2	3	6
Greater accuracy.....	2	5	4
Overcoming clerical labor shortage.....	2	2	3
New information.....	—	2	4

^{1/} Some of the 20 companies listed several objectives as of equal importance.

Savings in the amount of equipment and space for data processing operations were also important objectives. With their computers, these offices expected to have the capacity to process a growing volume of data without having to expand the office area occupied or the physical volume of equipment used.

Although cost saving was the primary objective, a number of companies ranked high such goals as greater accuracy, timesaving on preparing reports, and new information. These latter firms, no doubt, expected that such gains would also ultimately yield moneysavings, by reducing the cost of data processing and by contributing to a more efficient management.

Achievements of Electronic Data Processing

Seventeen offices (all for which data were available) reported they had achieved some economies in their operations. Many offices reported reductions in the time required to prepare reports. Others stated that existing clerical staffs were able to process a larger workload, including information hitherto not available.

Factors in precisely measuring the gains in output per man-hour are complex. It was difficult, for example, to indicate exactly the extent of preparatory work involved in converting to electronic data processing. Also there was no measure by which to determine whether gains were achieved in the productivity of the whole office as a result of the use of electronic equipment.

Some examples of the savings in elapsed time required for different applications, nevertheless, can be cited, as follows:

A large insurance office processed 141,000 premium billings in 4 days before electronic data processing. With the computer, 2 days are required to process 200,000 billings, a reduction in unit time requirements of 64 percent.

A manufacturing company achieved a 40-percent time-saving in preparing a report on customer sales and the amount of information taken from each invoice was doubled.

The office of one manufacturing company required 5 days to prepare a payroll for 2,000 employees. This was reduced to 2 days for a payroll of 4,000 employees, an 80-percent reduction in time per unit.

A large corporation reduced by 75 percent the time required to prepare statistics on orders and shipments, although the number of items processed was 25 percent greater.

A utility company reported a 28-percent reduction in unit time requirements for processing its customer billings. The number of days between the meter reading and the mailing of the bill was reduced from 7 to 5. About 38,000 bills were processed daily.

A manufacturing company reported a 66-percent reduction in time for preparing production cost reports, despite a 25-percent increase in items covered.

An insurance company reduced by 80 percent the time for preparing a report on agency experience, making possible the preparation of a monthly instead of a quarterly report.

These examples relate to a specific narrow data-processing operation and, therefore, are impressively large. Where the number of persons employed on these operations was also reduced, the savings in terms of unit labor requirements were even greater than the unit timesavings.

Several offices reported savings in space and equipment—a form of capital rather than labor savings.

A chemical company, for example, used nine reels of magnetic tape, which could be fitted into one drawer, to store data previously needing 12 filing cabinets.

An insurance company reported savings amounting to \$215,000 in annual rentals for 104 punchcard machines to do the work now done on the computer. In addition, the number of punchcards was reduced by 2.5 million per month.

A somewhat less tangible accomplishment was the acquisition of new information. Eight offices reported a total of 18 instances of new information on company operations made possible through electronic data processing. Although the amount of savings is difficult to determine, such uses, no doubt, resulted in tangible savings in the nonclerical operations of these companies.

One manufacturing company found it feasible to prepare two reports not previously available: a semiannual analysis of time spent on machine tool maintenance and a weekly report on the efficiency rate attained on each incentive job.

A large utility company now prepares fuel analysis, station efficiency studies, and data on transformer loads—reports not hitherto available.

New reports prepared by a large chemical company include gross profit analysis, forecast of depreciation for budget, analysis of freight costs, analysis of return sales and discounts by product, and comparison of gross profit by product.

In short, electronic data processing appeared, from the information reported by the offices in the survey, to provide a high-speed, accurate, reliable, and flexible means of performing a wide variety of tasks more efficiently.

Chapter V. Planning in Introducing Electronic Data Processing

Introduction of a computer involved a sequence of steps often extending over a fairly long period of time, rather than a single act of conversion. The physical installation of the equipment was only one step in this sequence. The extended period required for changes in methods, procedures, and office layout provided an opportunity for planning changes in the staffing plans for the office.

The sequence of steps may be divided into four phases: First, an intensive study of the feasibility of the new technology for the office's operation; second, planning and preparation for applying the computer; third, physical installation and testing; and finally, normal operation.

These phases generally spanned a considerable time period. The average time reported by 17 companies, from the beginning of the first to the beginning of the last step of the sequence, was nearly 3 years. One company took only 17 months, whereas two others required as long as 5 years to complete these phases of introducing the computer.

The importance of a long time period for planning changes among office employees was particularly emphasized by officials at one large company:

The conversion . . . takes longer than is anticipated. . . . The changeover is never precipitous—it never occurs between Friday evening and Monday morning. . . . We were given much more time to handle the personnel problem than we assumed 4 years ago would be available. The whole process of reassignment can be a more orderly and gradual affair than we had anticipated.

Intensive Study Phase

The first phase of the introductory process at the offices studied involved essentially the orientation of only a small number of key management officials.

Typical steps involved attendance at formal classes and conferences where basic information about the new equipment was given; an investigation of the economic "feasibility" of its use, covering, for example, comparative labor costs of different systems, types of operations adaptable, and necessary procedural changes; and finally, a decision by top management, based on the investigation, to make the large investment required.

The entire time spent on this study phase, from the earliest informal investigation of the equipment to the final decision to make the installation, is somewhat difficult to estimate, but it was fairly long. The offices studied reported that they required, on the average, about 16 months to carry out

their feasibility studies. Two large companies, which were among the first to consider electronic data processing for business operations, reported that a committee spent more than 5 years on a part-time basis studying the feasibility of the new equipment. Several others, however, gave only perfunctory review, readily convinced that computers would produce major economies and be applicable to many operations.

Planning and Preparing for Computer Applications

Once the decision to purchase the computers was made and the order placed with the manufacturer, the new system became the concern of a larger group of employees. While awaiting delivery of the computer, it was generally necessary to make changes in office layout for the installation of the equipment (including the air-conditioning and electrical connections), to write the procedures and instructions to guide the computer in its initial application, and to prepare employees for the new technique. These preparatory steps were taken without disrupting the existing systems of data processing.

Since only a few large-scale electronic data-processing systems were being produced at the time of the survey, the waiting period prior to delivery was often relatively long, averaging about 15 months; one company waited 2-1/2 years.

Some of the most important steps in planning personnel changes took place during this phase. First, management generally informed employees about the nature of the change and the employment policies to be followed. Second, the content of the new positions was defined, salaries were established, and the staff was selected and trained.

Installation and Testing

The physical installation of the electronic data-processing system, the third stage, resulted in few immediate, widespread job changes among the employees of the offices studied.

Thus, before beginning operations, it was usually necessary for technicians to test and adjust the complex computer system. Responsibility for this prior to formal acceptance by the users rested with technical employees of the manufacturers, who often remained in the office for some time after installation to assist the company's employees in operating the new equipment.

Normal Operation

With the initial use of the computer, the more active phase of personnel planning began. At first, some offices used both the old and new methods to assure that work would not be interrupted in case the new system failed to work smoothly. Such parallel operations required additional personnel or overtime and lasted, in some cases several months.

Finally, when the computer system could be operated on a normal basis, reassignments and transfers were undertaken for employees whose jobs were eliminated. Since electronic data processing was applied to the work of an office on a piecemeal basis, as indicated earlier, the impact on employees extended over a long period of time.

Chapter VI. Informing Employees About Changes

In view of the computer's supposed potentialities for labor savings, management made special efforts to allay the fears of employees about their jobs by informing them in advance about the changes. The responsibility for administering this and other policies regarding the changeover was generally borne by the personnel staff, under the direction of a high-level company official.

Methods Used in Informing Employees

A majority of the offices notified their employees of installation plans from 1 to 6 months in advance of the actual installation. A few waited until the computer was put into operation. In seven offices, employees were notified a year or more in advance; in one case, at the time that the feasibility study was undertaken.

Existing channels of communication, such as employee newspapers, were used to describe the equipment and the company policies regarding personnel changes to all employees. Some offices supplemented these announcements by special letters or circulars. One office, for example, distributed an illustrated brochure describing the speed and capacity of the computer and presenting the company's employment policy. (See table 2.) Management officials in some offices first briefed supervisors, who in turn met with employees.

In seven offices with collective bargaining relationships, the union constituted the channels through which employees were informed about the changes and the problems of adjustment were considered. ^{5/}

Information Given

A majority of the offices gave assurance that no employee would lose his job with the company or suffer loss in pay because of the electronic computer. This assurance was in line with a long-existing policy of retaining employees with permanent status, as long as their performance and conduct were satisfactory. Some offices issued statements to all employees, over the signature of the highest official, to give more authority to their reassurance. Others referred to the likelihood that the steady growth of business and normal attrition would avert layoffs.

^{5/} Three of these offices were in manufacturing companies; 2 in transportation; and 2 in public utilities. All but one of the unions were affiliated with the AFL-CIO. In 4 offices, clerical employees were represented by the same union which represented production workers; in 3, they were represented by unions whose jurisdictions were more or less confined to clerical and related employees.

Table 2. Management communication with employees about changes

Company	Channels used and information given
A -----	Talks by supervisor to employees. Articles in company periodical. Company president announced that no employee would "lose his or her job because of electronic computer." Acknowledged elimination of some jobs, but promised reassignment to satisfactory jobs, no downgrading, probable upgrading, less drudgery in some tasks.
B -----	Articles in company bulletins and newspaper publications.
C -----	Articles in company periodicals. Talks by supervisors and technical staff. Written notice to union posted in all offices. Notice of changes to take place at end of 3-month period. Union given list of all jobs to be abolished or created. Job changes posted in areas affected.
D -----	Articles in company newspaper. Talks by supervisors with union grievance committees. Press releases. Timetable of installation. Company policy on reassignment. Union representatives were told that no one would be downgraded or laid off.
E -----	Letter from comptroller to all employees. Press release just prior to computer delivery. Notice of installation and pledge of no displacements.
F -----	Memorandum from top management to department heads directing that all employees be informed of company's policy statement. Supervisory staff met with employees to explain that there would be no displacement; that all would be retained; that there would be no reduction in salary for any affected employees; and that some employees would be upgraded.
G -----	Circular containing announcement signed by president sent to all employees. Explained uses to be made of computer. Expected it to provide a better method of processing repetitive and monotonous tasks. Assured all employees doing a good job they would not be released; that normal attrition, reduced hiring, reassignments and increase in business would accomplish transition to the computer. Special effort to reassure long-time employees.
H -----	Notice to union at time of placing order for computer. Management held meetings with union representatives. Discussions between individual supervisors and employees in their departments. Explained scope of the change and notified that while company could not guarantee their retention, it would make every effort to place them either on computer work or positions of similar level.
I -----	Notice given to union. Meetings of supervisors and employees. Asked union to offer suggestions to implement transition without disrupting effect. Supervisors told employees of proposed installation, timetable for applications, expected impact, and gave assurances that no employee would lose in pay or employment status. Upgrading indicated for those qualifying for computer jobs.
J -----	Meetings of supervisors and employees. Motion pictures, articles in company publications. Showed computer installations and operations. Supervisors discussed computer functions and company policies to assure employees of no job loss. Information on 2-year plan to schedule changes so that normal attrition would take care of surplus positions. Pledged acceptable reassignment, no downgrading, possible upgrading.
K -----	No official statement made in reference to computer installation. News of computer installation came to employees via "grapevine". Supervisors gave answers to direct inquiries, insofar as they could supply information sought.

Table 2. Management communication with employees about changes—Continued

Company	Channels used and information given
L -----	Announcement in company publication including statement by president. Described computers and told of planned functions. Assured employees there would be no job loss and that computer would raise general level of jobs in the areas affected.
M -----	Notice to employees in affected department 3 months before delivery. After installation all employees were notified at meetings, by memorandum from company president and other officials, and employee magazine. Stated company policy, as affirmed by president, that no employee would lose his job because of change in methods.
N -----	Meeting of Division Chief with the employees of the sections to be affected. Reasons for installation of computer. Stated that no employee would lose his job or be reduced in salary level. Wherever possible, employee's job preference would be given every consideration.
O -----	General notice to staff. Interviews with employees affected. Announced acquisition of computer. Stated that Personnel Department would study changes to ease any dislocations and to effect an orderly transition.
P -----	Memorandum. Meetings of company officials with supervisors and union stewards. Stated that computer installation would be a gradual, long-term process; that there would be no layoff; that attrition would take care of displacement problems, if any; that same rates of pay would be maintained.
Q -----	Statement by company president in home office news publication. Information about the computer equipment; job security; selection of personnel.
R -----	Notice to union. Press release. Article in company publication. Notice to union listed areas to be affected and reaffirmed company policy on displacement as governed by union contract. Article described equipment ordered.
S -----	Statement at time of feasibility study. General notices issued shortly after placing order and just before delivery. First statement informed employees of feasibility study. Second statement gave notice of computer order. Followed by meetings with management personnel who in turn informed employees. Reassurances of no job loss or downgrading.
T -----	Speeches by company officials. Statements in company magazine. Explained computer operation. Assured of no job loss or downgrading. Stated repetitive, lower paid clerical jobs would be reduced while many higher paid, more interesting jobs would open up for qualified personnel.

The statement given by one large insurance company, signed by the Chairman of the Board, exemplifies the kind of positive assurance given:

As the business grows, the records we keep and the work we do with them in the home office grow in proportion. It has not been easy to find the number of new employees needed each year to meet this growth and to replace those who leave us. Electronic data processing will help to relieve these pressures, while opening up new avenues to improved service for policyholders and our field forces. No employee will lose his or her job because of changes brought about by the 705's use, and for many there will be opportunities for rewarding new kinds of work and for increased responsibility as new methods of operation take effect.

The approach adopted by some offices took account of possible dislocations and offered more conditional assurance of job security. Thus, one company informed its employees as follows:

Although the content of a number of jobs undoubtedly will be partially changed during this period, we are confident that the studies being made by the personnel department will ease any necessary dislocations, and that transition from the present way of processing data to the electronic method will be accomplished in an orderly fashion.

Union Contract Provisions

Procedures for notification in the provisions of contracts covering the establishment of new jobs, wage rates, promotions, and transfers were applied in the changeover to electronic data processing.

Three union contracts contained explicit provisions for advance notice of the introduction of technological changes. One contract (negotiated after the first computer installation had been made) contained an "Automation" clause under the section on "Seniority:"

When the installation of mechanical or electronic equipment will have an effect on the job status of employee, management shall review the matter with the Local Union Grievance Committee in advance of such installation.

The second contract gave in some detail the circumstances that would require notification:

The management agrees that as to major changes in business or practice or in the manner of operating units of business, it will give advance information to the union as to contemplated changes as would reduce the number of employees or the pay of the employees in a job classification or work group or would cause the transfer of a substantial proportion of the employees in a job classification or work group into one or more other classification or work groups.

Finally, the third contract spelled out the scheduling of the notice. It required that whenever the company wanted to put more work on the computer, the union was to be notified at least 90 days in advance, with a statement as to the number of workers affected. Within 30 days after the notice, the company and the union were to begin negotiations about the "manner and conditions" under which the work would be moved.

Attitudes of Unions

The general attitude of the unions visited, as expressed in contracts and reported by officials, was to recognize management's need to improve productivity and to accept the introduction of technological advances. No one was opposed to the introduction of electronic data processing. One contract, for example, stated that:

It is understood and agreed to be the duty of the company and the Brotherhood to cooperate fully both individually and collectively . . . to further the efficiency and economy of operations.

Union officials were particularly interested in having prior notice and an opportunity to consult with management so that any problems of employee adjustment might be anticipated and jointly settled. The union viewpoint was best summarized in the following statements by officials of one office worker's group:

Automation will cause relocation of employees and some hardship. However, if technological improvements are instituted with good judgment and consideration for human needs, they will be a good thing for the people and for the country . . . the responsibilities of a labor organization are to negotiate suitable provisions with management in order to accommodate new conditions. . . .

The union can work with management to secure opportunities for present employees to be trained on all types of newly installed equipment. It can help to set up proper conditions of work with fair rates for new jobs. It can speak up for older employees who might otherwise be dumped out by automatic processes or new people who operate the new equipment.

Chapter VII. Displacement, Reassignment, and Retraining

A major question arising upon introduction of electronic data processing is what happens to employees whose positions are eliminated? The answer depends partly on the measures that are taken regarding displacement, reassignment, and retraining of such employees. This chapter describes the practices adopted by the companies studied. Statistical data on the extent of job changes will be presented in the following chapter.

Procedures for Avoiding Displacement

One important task of personnel administration was to develop internal procedures to achieve laborsavings without laying off employees. Layoffs were often averted by matching the desired reduction in employment against the reduction resulting from quits, retirements, death, etc. Such planning involved the coordination and control of hiring policies of the entire office, including areas not affected directly by the change. ^{6/}

Some offices, for example, reported that they reduced all hiring so that employees affected by the computer could be readily reassigned. One company indicated that when it became necessary to fill vacancies during the conversion period, employees, particularly married women, were hired on a temporary basis, so that such jobs could be filled later by permanent employees whose jobs in the affected areas were to be eliminated. Some offices temporarily scheduled overtime in the affected unit prior to the changeover, rather than hire additional employees who might later be displaced.

Reassignment Practices

Since the policy generally was to avoid laying off employees whose jobs were affected, primary attention was given to reassigning and transferring employees to other positions. Efforts were usually made to minimize dissatisfactions, particularly among long-service employees, that arose in changing their duties, associates, and surroundings, without negating the company's desire to effect economies.

In a majority of offices, management transferred employees to other positions according to procedures customarily followed when particular jobs were eliminated. (See table 3.) Essentially, each employee was treated as

^{6/} See appendix C for the type of personnel planning endorsed at a meeting of the International Labor Office's Advisory Committee on Salaried and Professional Workers, in December 1959.

Table 3. Practices reported in reassigning and separating employees

Company	Practices
A -----	No separations were required because of normal attrition in affected area and need for clerical workers elsewhere in office. Reassignments were jobs within affected unit requiring little or no new job skills.
B -----	No separations or reassignments of employees were required because of plant expansion at time of computer installation.
C -----	Reassignments and separations were made in accordance with the seniority provisions of the union agreement. Jobs to be eliminated were posted. To avoid separations, about 30 employees were offered transfers to a company office in another city. About 25 percent accepted the offer. The rest were subsequently reassigned. Agreement also provided for layoff benefits or lump-sum severance pay.
D -----	No separations were required as new hires were reduced to allow displaced workers to fill job vacancies. Reassignments were made according to seniority provisions of union agreement. Posted job openings in appropriate areas. Placed employees on temporary assignments until permanent assignments were available. Agreement also provided for reasonable training arrangements to permit employees to qualify for available jobs. In the event of layoff, because of permanent discontinuance of a substantial part of a department, union agreement provided that employees with 3 or more years of service may receive severance pay. Other laid-off employees with at least 2 years' continuous service may receive supplemental unemployment benefits.
E -----	No separations were required. Reassignment was negligible.
F -----	No separations were required because of turnover and continued company expansion. Reassignment of some employees involved transfer to positions of lower grade with retention of the higher rates of prior positions.
G -----	No separations were required because of continued company expansion. Extent of reassignment was reduced among permanent employees by placing some younger women or potential military draftees in units likely to be affected by later computer applications.
H -----	No separations were required owing to growth of company and normal turnover. Reassignments were governed by union provisions on seniority. Affected employees were transferred to positions of equal or higher grade than those previously held.
I -----	No separations were required. Within framework of contract provisions, company policy is to cause as little disruption as possible. "Less adaptable" employees were reassigned to related work. In the event of layoff, union agreement provided that years of service and merit would be considered and separated employees would be given priority in future hiring.
J -----	No separations were required. Reassignments to units which might later be affected by computer operations were avoided. Effort was made to reassign "less adaptable" employees to related work and "readily adaptable" people to positions involving more changes in job content.
K -----	Separation of represented employees was governed by the union agreement. Layoff was on the basis of seniority for hourly rated employees and on a merit basis for salaried employees. A severance pay provision was applicable only to the latter group. Laid-off employees were given preference in rehiring. While reduction in force was imminent, there was no outside hiring. Reassignment also covered by the agreement was on the same basis as that used for layoff.

Table 3. Practices reported in reassigning and separating employees—Continued

Company	Practices
L -----	No separations were required. Reassignments were made to jobs of comparable difficulty and importance or higher. In some instances, however, it was necessary to place people temporarily on assignments of less importance. In no case was salary reduced. These employees were upgraded to their former level as soon as vacancies occurred.
M -----	No separations were required mainly because of normal attrition and the need for clerical help. Some departments accepted transferees whom they did not particularly need in order to comply with the president's announced policy of no layoffs.
N -----	No separations were required. Reassignments were made to units not likely to be affected by the computer, in order to avoid double displacement. Transfers of employees were made so as not to interfere with their normal promotional opportunities or with the promotional opportunities of those in the units to which they were transferred. Temporary assignments were made to special projects until permanent positions could be secured. Efforts were made to place "least adaptable" employees in related work sections, reserving the most adaptable for placement elsewhere.
O -----	No separations were required. "Less adaptable" employees were reassigned to units not likely to be affected by introduction of the computer. Special training classes were conducted to create or update unused skills, such as typing or keypunching, to permit greater flexibility in transfers.
P -----	No separations were required. Hiring was reduced when a labor surplus appeared imminent. During conversion period, married women were hired on a temporary basis. Reassignments were made to positions of lower grade, but previous pay rate maintained. In the event of layoffs, the union contract provides for separation on the basis of seniority, total company service governing. Before layoff provision is applied, contract requires negotiations in an attempt to find reassignment.
Q -----	No separations or reassignments were required.
R -----	No separations were required. Reassignments were made according to union contract on the basis of seniority, fitness, and ability. Fitness and ability being equal, seniority prevailed. During the transition period, under a special agreement, vacancies were filled on a temporary basis with notice to new employees that they would be displaced when employees from affected areas had to be reassigned. In the event of layoffs, the union contract provided for a severance allowance.
S -----	No separations were required because of normal attrition and use of some temporary employees during the conversion period. Reassignments were made on a noncompetitive temporary basis pending eventual posting of permanent assignments. Maintenance of pay rate level was promised for any who might be downgraded in job level.
T -----	No separations were required. Reassignments negligible. No special provisions for reassigning employees.

if he were being placed for the first time. Personal records were reviewed and the individuals interviewed. The aim in a majority of offices was to place employees at the same or higher wage or salary rates. Where it was necessary to reassign an employee, particularly one with long service, to a lower paying classification, most offices maintained the pay rate previously held. In one instance, a tabulating machine operator with 23 years' service at one insurance company was transferred to a routine clerical position classified at several grades lower. No change was made in the salary paid.

Displacement Provisions of Union Agreements. In unionized offices, the procedures governing displacement or transfer of employees, which were formally set forth in the existing union contracts, were applicable to the changes resulting from the introduction of the computer. A key principle of these provisions was that seniority, or length of service, was an important, and sometimes the only factor, in determining the order of displacement or transfer. Another important point was that any dispute about the application of these rules was to be settled through the grievance machinery.

Basically, three types of seniority protection were offered. Some followed a straight seniority rule, under which length of service alone determined the order of displacement or transfer. The applicable provisions of one contract read:

When a reduction in force is necessary, temporary and probationary forces shall be laid off first.

In case it is necessary to further reduce the number of employees in a job classification, employees who are lowest on the seniority list shall . . . be demoted to the next lower job classification in accordance with the lines of demotion set forth . . . If such demotions or transfers necessitate a layoff from the lowest job classification in the promotional series, as listed . . . service shall govern.

Another type of protection made seniority the primary factor but also allowed management some discretion to consider other factors; one agreement provided:

If at any time it becomes necessary, in the opinion of the company, to lay off employees for lack of work or other proper cause . . . or to transfer or demote employees to such extent as will avoid the making of one or more imminent layoffs . . . in the selection of any employees who are to be laid off, transferred, or demoted, preferred consideration shall be given to length of continuous service in the company.

A third approach provided that seniority was the deciding factor when the individual employees were relatively equal in merit. For example, a clause of one contract stated:

In all cases of decrease in forces or rehiring after layoffs, the following factors as listed below shall be considered; however, only where both factors a and b are relatively equal shall continuous service be the determining factor:

- a. Ability to perform the work,
- b. Physical fitness,
- c. Continuous service.

Besides establishing the order for layoff and transfer of employees, a few agreements made special provision for consultation in advance of any displacement. Such provisions were in addition to the grievance machinery under which any dispute over transfers, etc., would be considered. One contract provided that:

Whenever, by reason of the workload, the company contemplates a layoff, the company will negotiate with the union to formulate a program for spreading work, moving employees from one group or department to another, or other appropriate action. . . .

Finally, the special program adopted for employees of a railroad covered by the survey offered extensive benefits in case of displacement. The program (originally adopted industrywide in 1936 in connection with the coordination and merger of lines) was applied in this company, after collective bargaining negotiations in 1956, to cover office employees who might be displaced by the introduction of electronic data processing.

The agreement provided that a displaced employee would not be downgraded in pay or working conditions for a period up to 5 years, depending on length of service, and would be reimbursed for traveling and moving expenses, if transferred to a different location. In case of layoff, he would be given unemployment benefits for periods from 6 months to 5 years or lump-sum severance pay, depending on his length of service, and maintenance of hospitalization, pension, and other benefits.

Since this program was limited only to employees displaced as a result of the use of electronic data processing, one problem in applying it was to distinguish this group from those who had been reduced in force because of lack of work. Resolving this issue satisfactorily involved considerable negotiation between management and union representatives.

Special Reassignment Programs. A few offices not covered by union agreements, where extensive changes were made or expected, developed policies for reassigning employees that also gave special attention to long-service

employees. These special provisions supplemented the transfer procedures normally applicable. An objective of these measures was to minimize the extent of reassignment, particularly among the permanent employees of the office. Such programs often required extensive advance planning on the part of personnel officials. (See appendix D.)

One outstanding example of this approach was the set of principles developed by a large insurance company to guide the reassignment of its employees. The program took account of the continuing process of change. (See appendix E.) It stressed the need to avoid placing employees in positions where they might be subject to displacement a second time and underscored the importance of planning special projects in advance (for example, on work that had been deferred) to which displaced employees might be temporarily assigned.

Another insurance company, anticipating further applications of the computer, selected women employees and potential draftees for reassignment to units scheduled to be affected. This step was intended to reduce the extent of change among employees who were considered by the companies as probably more permanent.

Retraining

With one exception, formal programs to retrain employees affected by the electronic computers for other clerical positions were apparently not considered necessary. (The training programs for electronic data processing positions will be considered in chapter IX.) All companies reported that they tried to transfer such employees to clerical positions comparable in duties and skill to the positions held before the introduction of the computers. Such positions generally required only a relatively short period of on-the-job instruction to familiarize the employee with new forms and procedures.

One insurance company reported a somewhat more explicit training arrangement. A few employees affected by the computer were given an opportunity to revive unused but needed skills, by working with the typing and keypunching pools. Another company gave 18 routine clerical employees 1 week's training to become keypunch machine operators.

Specific reference to retraining of employees was made in one union agreement under an "Automation" clause:

In the event such mechanical or electronic equipment is installed, management shall provide reasonable training arrangements for the employees affected by such installations in order that such employees may have an opportunity to become qualified for available jobs.

Some Problems of Reassignment

In shifting employees from their customary positions, conflicts sometimes arose that required considerable administrative skill to resolve.

Placing Older Employees. Some offices reported difficulty in finding suitable positions for employees with long years of service. Because they had specialized in one type of work over a long period of time, such employees were sometimes presumed to be less adaptable and hence more difficult to place.

To minimize this source of difficulty, one company followed a policy of having the Personnel Division, rather than the operating unit, determine the personnel to be reassigned. Personnel officials then endeavored to place in dissimilar positions those employees whom they considered the most adaptable to change while reserving the more familiar work for those considered less adaptable.

Summing up the findings of 3 years' experience, a personnel official of this company recommended the following approach:

In these cases where it is evident that there is going to be some difficulty in placing the individual, there should be no attempt to place him in a hurry. Rather, a leisurely and thorough survey of all possible job opportunities both within the employee's present unit and elsewhere is in order . . . There is no step-by-step procedure to recommend . . . This is an area where the patience and understanding of a great many people are required if the individual is to be satisfactorily placed . . . If necessary, an appeal may be made to management people to consider the particular problem from a companywide standpoint, rather than from their own self-interest. . . .

Interference With Promotion Opportunities. Another source of difficulty in reassigning clerical employees arose from trying to assure for all employees the same promotional opportunities as existed before the change. Some companies, for example, reported difficulty in transferring high-salaried employees to positions in other clerical units with continuing salary and job growth opportunities, without interfering with the promotional opportunities of these already in these units.

Personnel officials of one large company suggested a temporary increase in the number of higher level positions to be offset by not filling vacancies at lower grades. The officials acknowledged, however, that these operating principles would be "easier to state than to carry out in practice."

Reassignment of Supervisors. Satisfactory reassignment of supervisory employees was often particularly difficult. Where appointments to these positions were made by promotion from within the organization, the problem

became doubly complicated. One company, for example, reported considerable resistance from operating officials who were reluctant to increase their budget.

The personnel staff of one large company recommended a careful review of the adequacy of supervision, throughout the organization, and where possible an increase in the number of supervisors. It suggested, moreover, that the need for reassignment could be reduced by advance planning that would eliminate supervisory positions through attrition.

Maintaining Salaries. Some conflicts arose in trying to maintain the salaries of employees temporarily assigned to lower grade positions. One office reported that employees receiving the lower pay normally attached to such duties at first resented the discrepancy, but were mollified when informed that such assignments were temporary, pending a shift to more appropriate duties.

Applying Union Agreements. The application of provisions of union agreements covering affected employees involved, in a few instances, some difference of opinion about the meaning of the language used in the contract. For example, in interpreting the automation clause (see p. 27), some question arose about the extent of management's obligation to retrain employees who were affected by electronic data processing. The union later sought to revise this clause to provide more specifically that retraining should be given not only to employees affected by the first computer application, but also to those affected by all subsequent applications.

Chapter VIII. Changes in Employment and Occupational Status

The extent to which employees in the offices studied were displaced, reassigned, upgraded, downgraded, or shifted in occupation was often a matter of judgment on such factors as the length of the period of observation, the identification of the group of employees observed, and the stage of the business cycle covered. Different interpretations of these factors and different methods of study might have yielded different results. A first step, therefore, in interpreting the data presented in this study is to understand the methods used to obtain them.

Method Used in Study

The approach involved tracing the changes in employment and occupational status in a specific group of individuals in each office. The period of observation for the study was 18 months, beginning 6 months before and ending 1 year after the installation of the computer. These periods were selected in order to exclude, as much as possible, the effects of factors other than the introduction of the computer.

The employees whose status was traced over this 18-month period included all those in the organizational units which performed the data processing work that was transferred to the electronic computer during the period. The data presented in this chapter, therefore, refer to those persons whose work was presumably most directly affected. Other employees may have been indirectly affected (some as a result of changes in the work of the directly affected group), but it was not feasible to obtain data on them.

For each individual, information was compiled from records on age, employment status, grade, and position, both before and after the change. Tabulations of these records, showing the extent of change among different age groups, are presented later in this chapter.

In assessing the data on employment and occupational changes, it is important to keep in mind three important considerations. First, most but not all of the changes recorded can be primarily attributed to the installation of electronic data processing. Some changes no doubt would have taken place in the normal course of events, but since it was not possible to establish a control group for comparative purposes, no exact evaluation of this factor is possible.

Second, not all of the personnel changes resulting from installation of the computer had been completed at the end of the study period. Some officials indicated that many employee adjustments take place more than 1 year after the installation.

Finally, the changes in employment were affected by the generally favorable economic conditions of the 1955 to mid-1957 period. It is not known, for example, if the quit rate among employees in the affected unit during a recession would have been high enough to allow offices to adjust the level of employment without laying off workers, as it was under favorable economic conditions.

Employment, Displacement, and Turnover in Affected Units

Six months before the change 2,815 persons were employed by 18 offices in organizational units which were doing the data-processing work that was transferred to electronic computers. As a group, these constituted a relatively small proportion of total employment at the offices visited. In 15 offices where data were available for this comparison, employment in the affected units represented about 5 percent of total office employment.

The relative importance of these units varied among the companies, depending on the nature of the computer application, the extent of its use, and the degree of mechanization that previously existed. In eight offices, the affected unit constituted less than 5 percent of total office employment; in four, 5 to 10 percent; and in three, the ratio was more than 10 percent.

The extent of displacement, reassignment, and turnover among 2,808 employees is presented in table 4. Approximately 85 percent of these employees were still employed in some unit of the 18 companies at the end of the 18-month period. Of those no longer employed, virtually all had left their jobs voluntarily. Employment in the affected units was about 25 percent lower.

Layoffs were negligible, reflecting the retention policies described earlier, growth of the workload, personnel planning, and rate of turnover. This absence of displacement, however, relates only to the experience of the offices up to 1 year after the installation, i.e., prior to 1958. As explained earlier, any subsequent layoffs or reassignments are not included in the data in table 4. ^{7/}

The rate of separation--15 percent over the 18-month period--was, as indicated earlier, a factor in avoiding displacement. Three out of four separations were employees who quit voluntarily. (See table 4.) Many were young women who quit, presumably, to become housewives. A few employees in the affected units were reported to have quit because of dissatisfaction with their new status, but the number was not given.

^{7/} For example, information obtained about one company where business had contracted revealed that some displacement took place at the end of 1958 among a group of employees whose work was placed on the computer. A reduction in force was carried out according to seniority rules and employees affected received severance benefits under a union agreement.

Table 4. Job status of employees of the affected units 1 year after introduction of electronic data processing, selected age groups ^{1/}

Type of job change	All employees		Employees under age 45		Employees age 45 and over	
	Number	Percent	Number	Percent	Number	Percent
Total	<u>2/</u> 2,808	100.0	2,164	100.0	644	100.0
No change in position ...	1,498	53.3	1,059	49.0	439	68.2
Position changed	883	31.3	724	33.5	159	24.7
Reassigned within same work unit	552	19.7	460	21.3	92	14.3
Transferred	331	11.8	264	12.2	67	10.4
To computer unit	52	1.9	46	2.1	6	.9
To other units	279	9.9	218	10.1	61	9.5
Quits, layoffs, and other separations	427	15.2	381	17.6	46	7.1
Quits	328	11.7	322	14.9	6	.9
Retirement and deaths .	42	1.5	3	.1	39	6.1
Leaves of absence	35	1.2	34	1.6	1	(<u>3/</u>)
Discharges	13	.5	13	.6	--	--
Layoffs	9	.3	9	.4	--	--

^{1/} Data relate to employees in affected units of 18 offices, 6 months prior to introduction.

^{2/} Total excludes 7 employees for whom data were insufficient.

^{3/} Less than 0.05 percent.

NOTE: Because of rounding, sums of individual items may not equal totals.

Employment of those aged 45 and over was more stable than that of the group under 45. Only 7 percent were no longer employed by the company at the end of the 18-month period and a majority of those had retired. No one of this group had been laid off.

Extent of Reassignment, Upgrading, and Downgrading

Nearly one-third of the group in the affected units had been reassigned, either to positions with different titles and duties within the same work unit or to positions in other units. Two out of three were assigned different duties but remained in the same organizational unit and in the same work environment. The others were transferred to other work units. It is noteworthy that of the approximately 2,800 in the affected units, only 52, or a little under 2 percent, were transferred to electronic data processing units. Most of these had been doing administrative, accounting, or tabulating machine work; only a few, chiefly from equipment operation, came from routine clerical work.

Older employees were shifted to other positions less frequently than other employees. A larger proportion--68 percent of the older group, compared with 49 percent of those under 45--were in the same positions they held before the computer installation, reflecting the seniority and other policies adopted to protect long-service employees. About one-fourth of the older group, compared with one-third of the under 45 age group, experienced some change in their duties, mostly within the work unit. A negligible proportion of employees age 45 and over--less than 1 percent--were transferred to electronic data processing positions.

A little over two-thirds of the employees who remained with the company during the 18 months covered by the study were in positions classified at the same grade as at the beginning of the period; nearly a third had been promoted to higher grade positions; and only a little over 1 percent had been downgraded. (See table 5.)

Promotions to a higher grade meant higher salaries. Those in the same grade received the same salary, except for general salary increases given to all office employees. Since many companies endeavored to maintain the salaries of those assigned to lower grades, downgrading did not necessarily mean a reduction in pay.

Among older employees, the amount of upgrading and downgrading was less extensive than among the others. Four out of five employees age 45 and over, compared with about three out of five of those under 45, were in positions at the same grade after the computer's installation. Since older employees probably had attained, or were close to their maximum grade levels, a lower rate of promotion was to be expected. Seniority and similar provisions protected them from downgrading.

Table 5. Grade status of employees in affected units 1 year after installation of electronic computers, by age 1/

Grade status	All employees		Employees under age 45		Employees age 45 and over	
	Number	Percent	Number	Percent	Number	Percent
Total	<u>2/</u> 2,372	100.0	1,775	100.0	597	100.0
Same grade	1,599	67.4	1,116	62.9	483	80.9
Higher grade	740	31.2	629	35.4	111	18.6
Lower grade	33	1.4	30	1.7	3	.5

1/ Grade status 1 year after compared with grade status 6 months before installation of computer. Data were available from 18 offices.

2/ Excludes 427 employees who were separated and 16 employees who remained at these offices but for whom data were not available.

Changes in Type of Occupation

Among the important questions about the implication of electronic data processing for office employees are what types of work are affected and to what extent are employees shifted from one type of work to another? To answer these questions, the positions of nearly 2,800 employees both before and after the change were classified into 10 broad functional occupational groups that cover the field of office work. The definitions of these broad groups and the classification of individual jobs at the offices in the survey are based mainly on descriptions and listings of office jobs shown in a study, by the U.S. Employment Service.^{8/}

Table 6 shows the type of work done by these employees 6 months prior to the computer installation and the percent distribution of the individuals in each group according to the type of work done 1 year after. The rate of separation for each group is also shown. A change in the type of work done implies a somewhat greater degree of readjustment and retraining on the part of an employee.

^{8/} See A Functional Classification of Recording Jobs, U.S. Department of Labor, Occupational Analysis Branch, U.S. Employment Service, November 1950.

Table 6. Percentage distribution of employees in affected units, by occupational classification, 1 year after computer installation

Occupational classification	Employment 6 months prior to computer installation		Occupational Classification												
	Number	Percent	All groups	1	2	3	4	5	6	7	8	9	10	Electronic data processing	Separated
All groups	1/2,772	100.0	100.0	1.6	6.2	6.0	22.3	15.2	0.1	1.3	14.1	15.1	1.4	1.8	15.0
1. Administrative	41	1.5	100.0	82.9	--	4.9	--	--	--	--	--	--	--	7.3	4.9
2. Supervisory ..	176	6.3	100.0	3.4	80.7	2.8	2.3	0.6	--	--	--	2.3	--	3.4	4.5
3. Accounting and professionals	157	5.7	100.0	1.3	3.2	81.5	--	--	--	--	--	--	--	8.3	5.7
4. Posting, checking, and maintaining records	719	25.9	100.0	--	.4	1.1	68.6	4.0	0.4	0.4	3.5	1.7	1.5	.4	17.9
5. Computing and statistical .	492	17.7	100.0	--	1.4	2.2	7.1	73.4	--	--	1.8	.4	.6	.4	12.6
6. Correspondence work	2/3	.1	100.0	--	--	--	--	--	--	--	--	--	--	--	--
7. Stenographic and secretarial	34	1.2	100.0	--	--	--	2.9	--	--	85.3	2.9	--	--	--	8.8
8. Keyboard or keypunch machine operations	447	16.1	100.0	--	.2	.4	4.5	1.8	--	1.1	72.9	2.2	--	.7	16.1
9. Tabulating and related machine operations	618	22.3	100.0	.2	2.4	1.3	5.5	3.4	--	--	3.6	62.0	1.0	3.1	17.6
10. Sorting, routing, classifying, and filing	85	3.1	100.0	--	--	--	34.1	1.2	--	--	9.4	8.2	23.5	--	23.5

1/ Excludes 43 employees for whom data were insufficient.
 2/ Insufficient data to warrant presentation of percentage distribution.

NOTE: Because of rounding, sums of individual items may not equal 100.

Nearly half of all employees in the affected units before installation of the computer were engaged in routine clerical work such as posting and checking records, computing, and filing. Close to two-fifths operated office machines such as tabulators and keypunch machines. About 14 percent were in administrative positions such as supervisors and managers, or as accountants. A small proportion were in somewhat less routine clerical work, such as correspondence and stenographic and secretarial jobs.

One year following the installation of electronic data processing, most of those still employed in the offices studied were doing the same type of work. About 16 percent of the entire group had been shifted to a different type of work, e.g., from tabulating-machine operation to computing and statistical work.

The extent of change among employees in tabulating, sorting, and supervisory work was greater than in other types of work. Administrative and accounting employees on the other hand, were shifted less frequently to other types of work. No doubt, the extent of shifting among the groups doing routine clerical work such as posting, filing, and machine operations was reduced because of the relatively high rate of separation among these employees.

Extensive shifting took place among the employees in tabulating and related occupations. Most of this group were transferred to nonmechanical clerical work, chiefly in computing, posting, checking and maintaining records.

The shifting of supervisors to nonsupervisory positions suggests a possible source of difficulty. About 5 percent of the supervisory employees were shifted to positions involving more or less routine clerical work and machine operation. Although these changes did not involve a reduction in pay, as indicated previously, they probably meant some loss in prestige.

Only 2 percent of the employees were transferred to electronic data processing occupations, and most of them were in administrative and accounting and professional work. Few employees from the routine clerical fields were assigned to the new types of work.

Changes in Total Office Employment

In addition to the approach described above, of recording changes in status among a group of office employees directly affected by the installation, changes in the total office of which the affected unit was a part must be recorded. Such changes reflect not only the net impact of installing the computer, but also the influence of other events that occurred at the same time, such as changes in volume and type of business or modifications of procedure that may have been unrelated to the technological change.

Total office employment at 17 offices for which data were available increased 7 percent from December 1953 to December 1957. In six offices, the increase was 15 percent or more; in seven, less than 15 percent; and in the remaining four offices, employment decreased.

Employment of all clerical and kindred workers during this period, as shown by U.S. Bureau of Census estimates for the Nation as a whole, increased by about 15 percent. This overall estimate covers employees in all industries and does not necessarily reflect the same conditions as those affecting offices in the survey. Thus, average office employment for the 17 companies tended to lag behind the overall increase. In 6 offices, the increase was greater; in 11, the increase was smaller.

The impressive savings suggest that electronic data processing reduced the rate of increase in the demand for clerical employees, especially for routine work. Several offices reported that after the installation of electronic computers, the need for overtime for data processing had been reduced, hiring cut back, and part-time employment curtailed.

Chapter IX. Organizing Electronic Data Processing

The introduction of electronic data processing required not only the reduction of some types of office employment, but also the organization of new functions and the opening of new job opportunities. This chapter discusses the adjustments involved in organizing the new work groups and in selecting, testing, and training employees, as well as some of the problems encountered, especially those concerned with older employees.

Number of Positions Required

Organizing a group of employees to manage, plan, and operate the computer was one of the first steps in introducing electronic data processing. This involved determining the number and type of jobs needed, describing the content, and setting the salary rates of the new positions. Since there was uncertainty about the extent, nature, and level of difficulty of the work, decisions about these matters were often tentative, subject to changes as experience dictated.

Electronic data processing required a relatively small number of positions in each office. The 20 offices in the survey had a total of 915 employees in electronic processing jobs with an average (median) of 29. The groups varied in size, from 9 employees in a manufacturing plant to over 200 in a large insurance company, reflecting the extent and type of application being made. The size distribution of these groups was as follows:

<u>Number of employees</u>	<u>Number of offices</u>
All offices	20
Under 10	1
10-19	2
20-29	8
30-39	5
40-49	2
50 and over	2

The tabulation excludes those employees in related positions, such as keypunch and tabulating-machine operations, who performed certain preliminary tasks to prepare data for the electronic computer.

Occupational Structure

The work of employees in these groups may be classified broadly as planning and programming; computer operation; and administrative and supervisory. The first group, 69.5 percent of the total, was engaged in analyzing and developing office procedures for electronic data processing and preparing the detailed programs or instructions for operating the computer. The second group, with 22.9 percent of the total, included the operators of the main

apparatus and of the related equipment, such as printers. Those who supervised and planned the work of these technical analysts, programmers, and operators represented 7.5 percent of the total.

The extent of job specialization within these fields of work varied among the offices surveyed. For example, many offices established separate positions of methods or systems analysts for the work of planning procedural changes, and programmers for the programming function. A few offices, on the other hand, combined these duties in one position. ^{9/}

No standard pattern was followed in organizing the job progression. Some preferred a single classification for programmer or analyst. Others set up positions at three levels of skill: for example, trainee analyst, junior analyst, and analyst. A common practice was to establish the position of method analyst at the top of a ladder which programmers and junior programmers at lower levels could climb as they acquired experience and skill. Generally, separate classifications were established for operating the main apparatus or console, with subordinate employees operating the auxiliary printers, etc. (See appendix F.)

Determining Salary and Wage Rates

A key step in organizing the electronic data-processing unit was setting the salary and wage rates of the new positions. Here, the existing position classification and evaluation systems proved adequate. Apparently, no modifications of the factors were necessary.

The experience of one large office exemplified some of the steps followed. First, staff members of the personnel department prepared standard job descriptions for the electronic data-processing jobs which identified the principal functions in terms of machines or equipment used, the supervision received and exercised and the working procedures applied. In classifying the new positions the personnel staff evaluated, in relation to other office positions, the following factors: (1) Preemployment training, (2) experience, (3) mental ability, (4) responsibility for performance, (5) responsibility for "contacts," (6) responsibility for directions, and (7) working conditions. For each of

^{9/} For detailed descriptions of the occupations in electronic data processing, see the following U.S. Department of Labor publications: Occupations in Electronic Data Processing Systems, Bureau of Employment Security, January 1959; and Automation and Employment Opportunities for Office Workers, BLS Bull. 1241, 1958.

Also see The Role of Humans in Complex Computer Systems, a report prepared by the Electronics Personnel Research Group, Department of Psychology, University of Southern California, for the U.S. Navy Department, Office of Naval Research, January 1959.

these factors, certain points on a predetermined scale were assigned. In rating console operators, for example, two factors in the evaluation scheme--mental ability and responsibility for performance--accounted for the majority of the total points which determined the grade and salary of the position.

Relative Level of Electronic Positions

The new positions of console operators and programmers were generally rated at the top of the salary structure in the offices surveyed. Salary rates for console operators were usually set at about the same grade as those of supervisors of mechanical tabulating sections and those for peripheral equipment operators were fixed at about the same level as those of operators of mechanical tabulating equipment. Programmers and analysts were rated somewhat higher than console operators.^{10/}

The relation of the new positions in electronic data processing to other office jobs is illustrated by the following cases:

At one office covered by a union agreement, console operators and programmers were classified at the highest grade in the clerical unit. The rates were close to 5 percent above the rate for the highest paid accounting clerk position in machine accounting department. Other clerical positions at the same level included senior grade accounting analyst and senior plant analyst.

The console operator position at one utility was classified at the same grade as the supervisor of the mechanical tabulating section and the operators of auxiliary equipment were rated the same as operators of mechanical tabulating equipment. Programmer analysts in this office were rated somewhat higher than console operators.

The salary range for console operators at one office was from \$397 to \$654 per month, compared with a range of \$245 to \$348 for tabulating-machine operators and auxiliary machine operators. Salaries for senior programmers ranged from \$459 to \$770 and \$397 to \$654 for junior programmers.

In brief, the introduction of electronic data processing involved the creation of a small group of jobs at the top of the grade structure for office employees. Although, this change raised the average grade of office

^{10/} A detailed and comprehensive survey of wage and salary rates for electronic data processing positions was not made in this study. For such data, see Automation Salary Survey, made by the National Office Management Association and published in Office Executive, March 1959, pp. 25-58.

jobs, only a small number of such positions were created in each office, and therefore the overall effect was negligible. In the absence of information on the distribution, by grade, of all jobs in the offices studied, it is difficult to determine the exact impact of the new jobs on the overall job structure.

Collective Bargaining on Classification and Rates

The salary and wage rates of some of the new positions in offices covered by collective bargaining agreements were negotiated by management and union representatives. The union's participation, however, was usually limited to console operators, auxiliary machine operators, and programmers. Method analysts and procedure specialists were generally considered part of the management and therefore outside the bargaining unit. (See appendix G.)

The machinery for collective bargaining over new rates was, as a rule, coordinated with the existing classification or evaluation systems. The initial preparation of descriptions and classifications of new positions was management's function under formal job evaluation systems. Two contracts set forth some basic principles covering their preparation.

In some offices, management classified the new jobs and put in force appropriate wage rates. If the union disagreed with such rates, it had the right to submit its objections to the grievance machinery. In other offices, management and union representatives discussed rates for new positions in advance. If no agreement could be reached within a specified time period, the rates went into effect, pending final settlement through the grievance procedure.

In one company, the union and management agreed to a limitation on the cost of upgrading of positions as a result of introducing electronic data processing. The contract provided that--

Changes in wage relationships as may be mutually agreed to by the company and the union resulting from the installation of new operating methods now underway . . . shall be effected, provided the cost of such wage changes does not exceed \$100,000 on an annual basis. The wage changes to be made will be determined after 6 months' experience with the new methods. . . .

Collective bargaining over the new positions sometimes involved complex and prolonged negotiations. For example, among the major issues, one group considered at the bargaining table were the establishment of specifications for electronic positions; inclusion of new positions in the bargaining unit; and the setting of wage rates for proposed classifications. To prepare themselves, labor representatives at this office attended a brief course on electronic data processing. They met with management 22 times before agreement was reached on points of difference.

Selecting Employees for Electronic Data Processing

All offices in the study sought qualified persons for electronic data processing primarily from among their own employees. Some offices, however, recruited a small number of employees for training positions. One insurance company explained that the purpose of its policy of utilizing its own employees was (1) to preserve promotion opportunities for present employees, and (2) to assure that the programmers would have a knowledge of life insurance principles, of the company's operations and procedures, and of the company organization. This did not mean, however, that its choice was confined to the group who were doing the data processing placed on the computer. The general practice, particularly in filling the programmer position, was to extend the area of selection to the entire office staff.

Selection procedures were of two general types. (See table 7.) One group of offices relied on a review of personnel records and recommendations of supervisors to draw up a list of employees considered qualified for various new positions. (Little publicity was given to the employees concerning the program.) Those who were interested were then given an aptitude test. Finally, the supervisory staff of the electronic data-processing group made its selection from among those who passed, taking into account education, experience, and other personal qualifications as disclosed in interviews and records, as well as the scores on the tests. At one office, for example, 125 employees were interviewed for the 10 electronic data-processing positions originally set up. Tests were given to those who were still interested and the final selection made from the 50 who passed.

Other companies adopted the "reserve pool" system of selecting employees. For example, one insurance company with a long-range program announced openings to all its employees and invited them to take an aptitude test for the new positions. Those who passed comprised the group from which the company selected employees to fill not only the initial openings on its staff but also subsequent ones that would be created with the expansion of electronic data processing. (See appendix H.)

Selection Procedures Under Union Agreements

In offices with collective bargaining, new positions covered by the contract were "posted" or announced to all employees, with information on duties, qualifications, pay, and working conditions. Employees were permitted to "bid" or apply for the new positions. One union agreement, for example, provided that:

All new positions or vacancies (except those of less than thirty (30) calendar days' duration) will be promptly bulletined at agreed locations, for a period of five (5) calendar days. Employees who consider they are qualified for such bulletined positions may file their applications within the time limit shown on the bulletin with the

Table 7. Methods of selecting employees for electronic data-processing positions

Company	Methods used
A -----	Reviewed employee records. An applicant's rating on the Wonderlic Personnel Test, given to all employees when first hired, was considered. No special tests were administered for selecting employees.
B -----	Reviewed employee records, sought supervisory recommendations, and gave 4 tests: Wonderlic Personnel Test; Schubert General Ability Test (to college graduates, only); Differential Aptitude Tests (A. Numerical Aptitude, and B. Abstract Reasoning). Different passing grades were used for each type of job. Experience with the company was given more weight than test results. No tests were given for the auxiliary equipment operator positions.
C -----	Announced openings to all employees through union. Gave Wonderlic Personnel Test and Aptitude Test for EDPM Programmers. For top analysts jobs, gave series of personality and intelligence tests, plus a 3-hour personal interview—all part of a management training program. No tests were given for console or auxiliary equipment operator positions.
D -----	Reviewed employee records and filled key positions. Next, announced openings to all employees, selecting qualified employees on basis of interviews and records. Also ran some newspaper advertisements. No tests given.
E -----	Reviewed employee records. Available and qualified employees were interviewed and selections made. No tests were given for selection of employees at first. (Aptitude Test for EDPM Programmers currently being given for methods analyst and programmer jobs.)
F -----	Announced openings to all who cared to take the Aptitude Test for EDPM Programmers. Those who passed test were interviewed and selections were made. Employees were assured supervisors would not be given individual test scores. No tests were given for the auxiliary equipment operator positions.
G -----	Supervisors were asked to recommend employees for positions; some employees volunteered to take training courses. Aptitude Test for EDPM Programmers was used in evaluating employees, together with other factors, including interviews. No tests were given for the console or auxiliary equipment operator positions.
H -----	Notice given to union of positions to be made available. Positions were described, requirements established; business and academic background standards set up; positions were posted; applications reviewed; applicants interviewed. No tests were given at first. Currently, all employees eligible for positions must pass Aptitude Test for EDPM Programmers.
I -----	Notice given of new positions. Aptitude Test for EDPM Programmers was given primarily as an aid to evaluating applicants. Experience in company operations was regarded most important. No tests were given for the auxiliary equipment positions.
J -----	Personnel officers reviewed employee records and informed top men in newly established electronic unit of likely candidates. Selections were made on basis of evaluation by supervisors. No tests were given.
K -----	Reviewed records of employees to select those to take qualifying tests: California Test of Mental Maturity, Kuder Preference Test, and then Aptitude Test for EDPM Programmers. Those with successful scores in each of these tests were personally interviewed by Manager of Data Processing Department who made selection. No tests given for the auxiliary equipment positions.

Table 7. Methods of selecting employees for electronic data-processing positions—Continued

Company	Methods used
L -----	Initially, employee records were reviewed for candidates. These were given a battery of company designed tests to determine general intelligence and reasoning ability. Arithmetic and vocabulary were most important factors. Selections were then made. (Subsequently, these tests were replaced by Aptitude Test for EDPM Programmers.) All applicants were assured that failure in any test would not adversely affect them in their jobs. First group of console and auxiliary equipment operators were not given any tests. Mainly selected from among other machine operators, with supervisor's recommendation most important factor.
M -----	For analyst and analyst-programmers, reviewed personnel data card files, employees work records, and gave personal interviews. No tests were given. For the positions of programmer and console operator, the Aptitude Test for EDPM Programmers was given. Test results plus other personal data were considered. No tests were given for the auxiliary equipment operator positions.
N -----	Applicants were given the following tests: A. C. E. Psychological Examination; Foust-Schorling Test of Functional Thinking in Mathematics; and Moore Mechanical Comprehension Test. Test results, personnel records, and personal interviews were used in selecting employees. Assurances were given that test results would not be disclosed to previous supervisors. No tests were given for the auxiliary equipment operator positions.
O -----	On the basis of interviews, candidates for planning and programming jobs were given the following tests: Wesman Personnel Classification Test; Watson-Glaser Critical Thinking Appraisal Test; Aptitude Test for EDPM Programmers; and the Strong Vocational Interest Blank Test. Positions were filled after considering both personnel records and test results. Applicants for console and auxiliary equipment operator positions were given the Strong Vocational Interest Blank Test.
P -----	Union was informed of openings and necessary qualifications. Applicants were then given a personal interview. If found acceptable, they were permitted to take a company designed test (since replaced by the Aptitude Test for EDPM Programmers). Those who passed were interviewed again and then rated on a number of factors, including age, company record, education, test score, and interview. Selection for position followed. No tests were given for the auxiliary equipment operator positions.
Q -----	Department heads were asked to suggest employees to be given training courses with understanding they might be returned to their original work sections. From among those who took courses, original group was formed. No tests were given.
R -----	Notice of new positions was given to union. Opened positions to all qualified employees in the general accounting department. Used Aptitude Test for EDPM Programmers in conjunction with other factors, in selecting employees.
S -----	Job openings were posted and applications invited. Department heads were asked to recommend qualified employees. The Aptitude Test for EDPM Programmers was given, together with several other tests designed by company's industrial psychologist. Tests were used primarily to provide a ready history of those who might not otherwise be considered. All persons examined were assured that the results would be confidential. No tests were given for auxiliary equipment operator positions.
T -----	Most candidates were selected from company's machine accounting section. All were given the Aptitude Test for EDPM Programmers. The test results, supervisory recommendations, educational background, and employee performance record were considered in making the final selection.

official whose name is signed to the bulletin. The senior qualified employee whose application is filed with the designated official within the time limits of the bulletin shall be awarded the position or vacancy. When no qualified employee applies within the time limit stipulated above, the company may proceed to fill the position with any employee or new employees. A notice of assignment showing bulletin number and names of all applicants, and designating the successful applicant shall be posted as promptly as possible.

All agreements provided that merit as well as length of service were to be factors in the final selection, with seniority determining the choice only when all applicants were equally qualified. If disputes arose over the interpretation of these provisions, they were to be settled through grievance and arbitration procedures. One agreement, for example, contained the following section:

Preference for promotion: In all cases of promotion of employees from one classification to another, the following factors shall be considered: (a) Length of continuous service; (b) knowledge, training, ability, skill, and efficiency; (c) physical fitness; and (d) attendance record.

Where factors (b), (c), and (d) are relatively equal, the length of continuous service shall govern. If action contrary to the foregoing is taken by the management, any employee who is aggrieved thereby may present a grievance for adjustment or determination as provided in article XI of this contract.

Another contract was less specific about the factors, other than seniority, governing the selection:

In selecting an employee for promotion or upgrading to an available opening the following standards shall apply:

Where ability, skill, and efficiency are substantially equal, preference shall be given to the most senior qualified employee within the applicable unit.

In short, although the senior employee under union contracts had some advantage in promotion to these new positions, he was first required to prove his ability in competition with younger employees.

Testing Applicants for Electronic Data Processing

Since the new electronic data processing jobs required training and differed from existing types of work, it was generally believed that a more or less objective and independent basis for predicting the success of applicants

was needed. Fourteen offices in the study gave some type of aptitude test in selecting programmers and analysts. In 10 offices, tests were also given in selecting console operators. Only three offices tested applicants for positions as auxiliary equipment operators. In addition, three offices made use of tests given to employees at the time of their entrance. The use of tests in selecting office employees had long been the standard practice in many offices. A few large companies employed staffs of industrial psychologists for research on methods of selection. In one large insurance company, psychologists administered tests to more than 500 office employees to fill about 100 electronic positions.

Three of the offices surveyed did not use tests to select employees for electronic data processing. Some officials expressed skepticism about the reliability of the tests available. They preferred to depend on the personnel officer's or supervisor's evaluation of the applicant's background and experience. One union official opposed on principle the use of tests for promoting office employees arguing that management already has adequate means of observing their work performance on related positions and of evaluating their potentiality for higher level positions.

The type of test generally used was designed to measure the learning ability of individuals rather than to test clerical skills or personality. Some typical objectives, as indicated on the tests themselves were "to test how well you can think;" ". . . how well you are able to reason analytically and logically;" and ". . . how well you can think in math." One widely used test, specifically designed for determining aptitudes for programming, was in three parts, covering the ability (1) to follow instructions in completing numerical series, (2) to see relationships among geometrical figures, and (3) to solve problems in arithmetic reasoning. (See appendix I for list of tests used.)

Some companies gave a number of tests. One company, for example, tested the applicant's aptitude in fields of engineering and physical sciences as well as in learning ability. Another company administered tests of vocational interest on the theory that persons with a strong preference for accounting would be successful in programming work.

The weight given to these tests in selecting employees varied from company to company. Many offices used the results only to eliminate those who could not pass, with the final choice depending on consideration of the applicant's record and personal interview. Other offices gave weight to the actual scores achieved in the test. One office, for example, adopted an elaborate screening procedure based on test results. Only applicants who had achieved a high score on the Wonderlic Intelligence Test, which they had taken upon entrance, were selected to take the California Test of Mental Maturity and the Kuder Preference Test. Next, those who received a high score in mechanical aptitude on the Kuder Test were eligible to take the Aptitude Test for Electronic Data Processing Programmers. Finally, only those who achieved a high score on the latter were personally interviewed by the manager of the data processing department before a selection was made.

Training Programs

One of the most important phases of the transition to electronic data processing was the special retraining of employees selected for the new positions in programming and operating the computer. The content of these jobs differed so greatly from their previous activities that the employees needed special training. Also more systematic training was required than that normally given by supervisors or the training department, to meet day-to-day changes in office equipment and procedures.

Both formal classroom instruction and on-the-job training were provided. All employees selected for planning and programming positions were given classroom training in the principles of programming. (See table 8.) A majority of the offices also gave console operators such courses and a few included their auxiliary equipment operators. Although the former group required this instruction in order to perform their duties, the chief purpose of giving console operators this type of training was to enlarge their understanding of the entire process of preparing instructions. They also comprised a reserve group who could be assigned to programming work, if needed.

The formal instruction was generally developed and presented by staff representatives of the manufacturer of the electronic computer. In a few companies, experienced programmers were used as instructors. The classes were held at the offices of the equipment manufacturer or where the computer was being installed.

The classroom instruction involved lectures and practical demonstrations of the new equipment. Trainees were also given opportunities to practice writing and coding instructions and testing them on the electronic computer. These courses generally lasted from 4 to 5 weeks.

Costs of training were paid by the companies. This included the tuition, the wages or salaries of employees while training, and transportation and some related expenses where travel was involved.

Training on the job was generally used in developing skill for operating the auxiliary equipment, such as printers and card-to-tape converters. The starting, stopping, and adjusting of these automatic machines through their cycles of operations was first demonstrated by representatives of the equipment manufactures.

Another form of on-the-job training was implicit in the progression system for employees in programming and planning. Since the general policy was to promote employees in the group to higher paid positions as openings occurred, each employee was usually given progressively more difficult tasks under the supervision of a more experienced programmer or analyst. One company, for example, advanced a junior programmer to a fully qualified programmer after only 1 year's experience and on-the-job training.

Table 8. Training programs for electronic data processing positions

Company	Planning and programming jobs	Console operators	Auxiliary equipment operators
A -----	4-week programming course at office by equipment manufacturer's representative. On-the-job training.	Same as for planning and programming jobs.	On-the-job training.
B -----	4-week programming course (or 16 weeks, part time) by instructors of company-operated school.	4-week programming course by company and 4 weeks of on-the-job training.	On-the-job training.
C -----	12-week programming course at equipment manufacturer's school.	8-week course at equipment manufacturer's school.	30 days on-the-job training required to qualify.
D -----	1 1/2-month programming course at equipment manufacturer's school or 3-month course at office by manufacturer's representative. Also, 3 months on-the-job training at specific job exclusive of other company training.	2 months on-the-job training.	1 month on-the-job training.
E -----	4-week programming course at equipment manufacturer's school. 6-12 months on-the-job training.	4 to 6 months on-the-job training. Also, 2 afternoon sessions on nature of equipment.	Same as for console operators.
F -----	5-week programming course at equipment manufacturer's school. 2-3 years' on-the-job training.	5-week programming course at equipment manufacturer's school, 1 year on-the-job training.	1 year on-the-job training.
G -----	4-week programming course at equipment manufacturer's school, plus company training course of 5 weeks for 4 hours a day, or 10 weeks for 2 hours a day, after regular workday, by manufacturer's representative.	Same as for planning and programming jobs.	Same as for planning and programming jobs.

Table 8. Training programs for electronic data processing positions—Continued

Company	Planning and programming jobs	Console operators	Auxiliary equipment operators
H -----	4-week programming course at either equipment manufacturer's school or at company office by manufacturer's representative. Also, 3-6 months on-the-job training.	Same as for planning and programming jobs.	1 month on-the-job training
I -----	5-week programming course at equipment manufacturer's school and subsequent on-the-job training.	Same as for planning and programming jobs.	Brief lecture session at equipment manufacturer's service bureau plus on-the-job training.
J -----	4-week programming course at equipment manufacturer's school, plus 1 year of on-the-job training.	4-6 months' on-the-job training.	4-6 months' on-the-job training.
K -----	4-5 weeks of programming instruction at equipment manufacturer's or 1 month of training at company office by manufacturer's representative. Also, 6 months' of on-the-job training for programmers and analysts.	4-5 weeks of instruction at equipment manufacturer's school and on-the-job training.	On-the-job training.
L -----	4-week programming course at equipment manufacturer's school or at company office by manufacturer's representative or by experienced company programmer; also, on-the-job training.	Same as for planning and programming jobs.	On-the-job training.
M -----	5-week programming course at equipment manufacturer's school; also, on-the-job training.	2 weeks of classroom instruction by chief console operator. On-the-job training for from 4 to 8 weeks.	On-the-job training for 3-4 weeks.
N -----	4-week, or more, programming course at equipment manufacturer's school or at the company office with instruction by experienced company personnel; also, 5 months' on-the-job training.	6-week course at equipment manufacturer's school and 4 weeks of programming instruction by company personnel; also, 10 months' of on-the-job training.	6 months' on-the-job training.

67

Table 8. Training programs for electronic data processing positions—Continued

Company	Planning and programming jobs	Console operators	Auxiliary equipment operators
O -----	5-week (full-time) programming course at equipment manufacturer's school or 8 weeks (half time) at company's office by manufacturer's representative or experienced company programmer; also, 6 months' on-the-job training.	8-week (half time) course at company office by manufacturer's representative or experienced company programmer. (Operators are qualified programmers.)	(Equipment operated by console operators.)
P -----	4-week programming course at equipment manufacturer's school and 5 weeks of formal training at company; also, 3 months' on-the-job training.	Same as for planning and programming jobs.	3 months' on-the-job training.
Q -----	12-week programming course at company office by manufacturer's representative; also, 1 year on-the-job training.	8-week course at company office by manufacturer's representative. Also, 6 months' on-the-job training.	6 weeks' on-the-job training.
R -----	4-week programming course at equipment manufacturer's school.	Same as for planning and programming jobs.	Same as for planning and programming jobs.
S -----	4-week programming course at equipment manufacturer's school; also, on-the-job training.	Same as for planning and programming jobs.	On-the-job training.
T -----	4-week programming course at equipment manufacturer's school; also, on-the-job training.	Same as for planning and programming jobs.	Same as for planning and programming jobs.

Some Problems of Organizing Electronic Data Processing

A number of complex problems relating to the claims and fears of employees arose in organizing and staffing new positions, just as they did in re-assigning employees.

The creation of new electronic data-processing units with relatively high-salaried positions, for example, tended in some offices to be resisted by officials and employees in other activities who felt their standing in the office threatened by the change. At one insurance company, supervisory officials who felt their status had been downgraded were reluctant to cooperate with the new unit in furnishing information about their procedures.

Uncertainty about the salary level of the new positions created problems in some offices. One company, for example, discovered that it had overrated some positions in setting temporary salaries at the outset of the program. Later, it was not possible to meet the salary expectations of the employees who were permanently assigned to these positions.

The use of tests to select employees were said to make some qualified employees reluctant to compete for the new positions. Since many persons qualified for the new work were middle aged and had had no recent schooling, one company made a special effort to assure all candidates that unfavorable results on tests would not be disclosed to their supervisors and, therefore, would not jeopardize their present position.

Differences between management and union representatives arose in some offices concerning the union's jurisdiction over electronic data-processing positions. In one case, some friction arose because tasks performed by union employees at one office were transferred to an electronic data-processing unit at another office of the same company which was not unionized. At another company, programmers were first considered part of management and, therefore, exempt from the provisions of the union agreement. Later, after prolonged negotiations, it was agreed that such positions were covered by the contract and that openings must be filled according to the provisions concerning promotions and seniority. The differences were finally resolved when the employees selected through these procedures proved to be well qualified to do the work.

CHAPTER X. Characteristics of Employees in Electronic Data Processing

Assessment of the effects of the introduction of electronic data processing should take account of the characteristics of employees selected for new positions, as well as of those whose jobs were eliminated. In this chapter, data from office records are presented on age, sex, education, previous occupation, and grade changes of those accepted for this new field of work. Although information on all employees who applied and were tested for the new positions, including those who were rejected, would be useful in understanding more fully the standards of selection, such data were not available.

Sex and Age of Employees

The distribution of employees in electronic data processing by sex and age is presented in Table 9. The characteristics of those who were in the affected units are also shown for comparative purposes.

These data highlight the dominant position of men in this new field of work. Men outnumbered women 8 to 1 in electronic data-processing positions. Among newly hired employees, the ratio in favor of men was even greater. But among employees in the units affected, women outnumbered men by 8 to 7.

Relatively few persons 45 and over were employed in electronic data processing. The median age of both groups was about 32 years, but only 10 percent of the employees in electronic data processing were age 45 and over, compared with 23 percent of those in the affected unit. Newly hired persons for electronic data processing, were younger, with a median age of 26, and no persons age 45 or over were hired for these new positions.

These differences reflect partly the preference explicitly reported by management officials. A high rate of turnover among women employees and the need for operators to work late shifts were cited as obstacles to the employment of women. Moreover, a majority of officials voiced a preference for employees in the 25 to 45 age group.

Besides the preferences expressed by personnel officials, the attitude of employees to these new jobs must be considered. A few offices, for example, reported that some qualified employees over age 45 were reluctant to apply for training for the new positions.

Educational Attainment

There was a striking contrast between the average educational levels attained by employees in the affected units and those in electronic data processing (table 10). All but 5 percent of the employees in electronic positions were at least high school graduates, whereas 17 percent of those in the affected units had not completed high school. Among those newly hired, more than 99 percent had completed high school.

Table 9. Employees in affected units and in electronic data-processing positions, by age and sex

Age and sex	Employees in affected units		Employees in electronic data-processing positions			
			All employees (including new hires)		New hires	
	Number	Percent	Number	Percent	Number	Percent
All employees	2,815	100.0	<u>1/</u> 915	100.0	<u>1/</u> 173	100.0
Under 25	784	27.9	177	19.4	74	42.8
25-34	860	30.5	412	45.0	95	54.9
35-44	527	18.7	237	25.9	4	2.3
45-54	466	16.6	80	8.7	--	--
55-64	170	6.0	9	1.0	--	--
65 and over	8	.3	--	--	--	--
Male	1,316	100.0	812	100.0	156	100.0
Under 25	207	15.7	145	17.9	62	39.7
25-34	443	33.6	374	46.0	90	57.7
35-44	253	19.2	212	26.1	4	2.6
45-54	285	21.7	73	9.0	--	--
55-64	122	9.3	8	1.0	--	--
65 and over	6	0.5	--	--	--	--
Female	1,499	100.0	103	100.0	17	100.0
Under 25	580	38.7	32	31.1	12	70.6
25-34	414	27.6	38	36.8	5	29.4
35-44	274	18.3	25	24.3	--	--
45-54	181	12.1	7	6.8	--	--
55-64	48	3.2	1	1.0	--	--
65 and over	2	0.1	--	--	--	--

1/ Excludes 1 person whose age was unknown.

Table 10. Educational level of employees in affected units and in electronic data processing

Educational level	Employees in affected units				Employees in electronic data-processing positions			
	All employees		Employees age 45 and over		All employees (including new hires)		New hires	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All levels	<u>1/</u> 2,799	100.0	<u>2/</u> 638	100.0	<u>3/</u> 915	100.0	<u>3/</u> 173	100.0
Grade school, nongraduate ..	8	0.3	6	0.9	--	--	--	--
Grade school, graduate	95	3.4	79	12.4	6	0.6	--	--
High school, nongraduate ...	374	13.4	209	32.8	40	4.4	1	(<u>4/</u>)
High school, graduate	1,600	57.2	191	29.9	340	37.2	26	15.0
Business school, graduate ..	255	9.1	64	10.0	42	4.6	3	1.7
College, nongraduate	273	9.7	62	9.7	100	10.9	9	5.2
College, graduate	162	5.8	19	3.0	316	34.5	112	64.8
College, postgraduate	32	1.1	8	1.3	71	7.8	22	12.7

1/ Excludes 16 employees for whom educational data were not available.
2/ Excludes 6 employees for whom educational data were not available.
3/ Excludes 1 person for whom educational data were not available.
4/ Number is too small to calculate percent.

About 7 percent of those in the affected group had completed undergraduate college programs or work beyond graduation; 42 percent of the employees in electronic data processing had graduated from college or had some post graduate work. Among those newly hired, nearly 78 percent had achieved this level.

Previous Work Experience

Table 11 shows the type of work done by those assigned to the electronic data processing unit, prior to and after the installation of the computer. Most of the programmers and analysts came from closely related types of jobs. About half of them were formerly in accounting and related professional work. Only a relatively small proportion had previously been engaged in routine clerical work. A little over one-fifth of those in programming and planning work were newly hired, primarily as trainees. A little over one-tenth were formerly in administrative and supervisory work.

Of the console and auxiliary equipment operators, the largest proportion had been transferred from occupations related to machine tabulation work.

Of those in the administrative and supervisory positions, about 75 percent were formerly in similar positions or in accounting work. Only 7 percent were newly hired.

Extent of Upgrading

The transfer of employees to electronic data-processing units from other parts of the office generally involved upgrading. Table 12 shows that 4 out of 5 were in higher grade positions after their transfer to electronic data processing. Some of these employees might have been promoted in the normal course of events.

Employees age 45 and over in electronic data processing were upgraded less often than younger employees, that is, only three out of four employees age 45 and over were placed in higher grade positions. This probably reflects the fact that some older persons had already attained high grades.

Table 11. Occupational classification of employees in electronic data-processing positions, by prior occupational classifications

Occupational classification prior to employment in electronic data processing	Percentage distribution of employees in electronic data-processing positions after computer installation study				
	Totals	Administrative and supervisory	Planning and programming	Console operation	Auxiliary equipment operation
All groups: Number.....	915	69	637	77	132
Percent.....	100.0	7.5	69.6	8.4	14.4
All groups.....	100.0	100.0	100.0	100.0	100.0
Accounting and professional	35.4	44.9	43.5	16.9	2.3
Administrative and supervisory.....	13.3	40.6	11.9	14.3	5.3
Tabulating and keyboard machine operation.....	13.1	2.9	4.4	31.2	50.0
Posting, checking, maintaining records, and filing	10.7	2.9	9.3	16.7	18.2
Computing and statistical..	5.4	--	6.0	2.6	6.8
Correspondence and secretarial work.....	2.0	--	1.7	5.2	2.3
Nonclerical.....	1.2	1.4	1.1	1.3	1.5
New hires.....	18.9	7.2	22.1	11.7	13.6

NOTE: Because of rounding, sums of individual items may not equal totals.

Table 12. Grade status of employees in electronic data-processing positions after transfer from other office units, by age 1/

Grade status	All employees		Employees under age 45		Employees age 45 and over	
	Number	Percent	Number	Percent	Number	Percent
Total.....	<u>2/</u> 741	100.0	652	100.0	89	100.0
Same grade.....	127	17.1	105	16.1	22	24.7
Higher grade.....	612	82.6	545	83.6	67	75.3
Lower grade.....	2	.3	2	.3	--	--

1/ Grade status after transfer, compared with grade status before being transferred to electronic data-processing positions.

2/ Excludes 174 newly hired persons.

CHAPTER XI. Implications for Older Office Employees

Older employees whose jobs were affected by the introduction of electronic data processing were protected, on the whole, from layoff or downgrading by the existing policy of assuring job security of all employees. They benefited from some awareness of the special problems facing older employees, as indicated by the provisions for job security in the event of physical disability; retirement benefits supplementing social security; and formal retirement counseling programs. ^{11/}

No older person, on the other hand, was hired to fill an electronic data-processing position. To some extent, this failure followed from the general practice of hiring persons from the outside only for the relatively low paid entry or training positions, which attract few older applicants. Within this framework, a few offices had highly restrictive age limits. A few insurance offices, however, had active programs of recruiting older women for part-time or seasonal work. At one office, the collective bargaining agreement stipulated: "The company agrees that there shall be no established maximum age limit on the hiring of employees."

An important aspect of the impact of the introduction of office automation considered in this chapter is the effect of aging on the ability to meet the requirements of the new positions. The approach taken in this study was first to identify what was demanded of employees in these positions at the offices visited and second to investigate the capacity of older persons to meet these demands on the basis of the findings of research workers as well as the experience of management.

Employee Traits Required

In order to determine the demands of electronic data processing jobs, personnel officials were asked to select from a checklist of aptitudes, temperaments, and knowledge factors, those that were considered in selecting employees. The list and definitions used were based on a research study by

^{11/} Although the disability provisions were applicable to employees of all ages, they were most relevant to older persons. They included medical examination to determine the extent of disability, reassignment to more suitable jobs, and modification of the work schedule of long-service employees. Two union contracts made special provision to protect seniority rights and maintain pay rates of disabled employees whose jobs were changed. (See appendix B.)

the U. S. Employment Service. ^{12/} Respondents were asked to differentiate between the traits which they simply look for and those which they particularly stress, in selecting employees for three different positions. In addition, they were asked to describe the kind of experience desired. Table 13 summarizes replies from 16 offices regarding the aptitudes, temperament, and educational level desired.

Aptitudes. Aptitudes refer to the specific potentiality for acquiring ability to perform a job adequately. In this category, the importance of mental factors rather than physical capacities, in all types of positions, is clear. Ability to understand instructions and underlying principles, i. e., learning ability, was listed as desirable by a large majority of officials and was stressed more frequently than any other, for both planning and operating positions. For planning positions, many officials also considered important an aptitude for writing reports and instructions. Although aptitudes considered important for clerical work--i. e., the ability to perform arithmetic operations quickly and accurately and to perceive significant details and tabulations--were listed as desirable, they were not stressed. Good motor coordination and manual dexterity were sought only in equipment operators but even in these positions such aptitudes were not considered critical.

Temperament. In describing the temperament required for planning and programming positions, respondents indicated a preference for employees who are readily adaptable to work involving change and dealing with data rather than with things or people. Particular stress was placed on adaptability to work requiring responsibility for carrying a job to completion and for meeting deadlines. Employees who operate electronic computers were required to be able to adapt readily to working under pressures of deadlines and unusual workloads and to meeting precise, preset standards.

Education. Most offices indicated that a knowledge of accounting was sufficient for electronic processing for business purposes. A knowledge of calculus and higher mathematics, usually acquired only in college courses, was not generally sought. Very few offices indicated that mathematical knowledge was critical.

^{12/} See Estimates of Worker Trait Requirements for 4000 Jobs (as defined in the Dictionary of Occupational Titles). U.S. Department of Labor, Bureau of Employment Security, 1956. Also, article by Sidney A. Fine and Carl A. Heinz, The Functional Occupational Classification Structure (in Personnel and Guidance Journal, November 1958, pp. 80-92).

Table 13. Employee traits desired for positions in electronic data processing ^{1/}

Employee trait	Planning and programming positions		Console operators		Auxiliary equipment operators	
	Number of companies--					
	Listing trait	Stressing trait	Listing trait	Stressing trait	Listing trait	Stressing trait
Aptitudes						
Person should have a special ability for--						
Writing reports and instructions clearly and effectively ...	15	6	6	0	2	0
Performing arithmetic operations quickly and accurately	11	2	4	0	1	0
Perceiving significant details in tabulations, etc.	12	2	9	1	5	1
Understanding instructions and underlying principles	16	9	13	7	12	6
Coordinating eye and hand or fingers rapidly and accurately.	0	0	12	3	11	2
Manipulating small objects rapidly and accurately	0	0	9	1	11	2
Temperament						
Person should be readily adaptable to work involving--						
Variety of duties and frequent change	14	6	11	1	10	0
Responsibility for planning and controlling an entire activity	15	7	4	3	0	0
Repetitive or short-cycle operations carried out according to set procedures	5	1	13	2	12	3
Judgments based on quantitative data	13	5	6	1	3	0
Decisions based on qualitative data	12	6	8	2	3	0
Deadlines, unusual workloads, and calls outside hours	12	5	14	4	13	2
Precise, preset standards	13	1	15	3	13	3
Educational level						
Person should have knowledge of--						
Theoretical mathematics	4	0	1	0	1	0
Calculus	5	0	1	0	1	0
Accounting	11	3	8	0	1	0
Decimal, fractions, percentages	11	1	8	0	6	0

^{1/} These data were obtained from 16 of the 20 companies visited.

Experience. Knowledge of company procedures that comes from experience in the office was specified by a majority of offices as desirable for the new positions. Experience in accounting work was considered important for programmers and machine-tabulating experience was preferred for operators.

In short, on the basis of information about the particular traits needed in electronic data processing, it appears that electronic-data processing jobs require individuals who are readily adaptable to change, who have ability to learn quickly, and who have at least a high school education, some company experience, and a sense of responsibility about their jobs. To assess the capacity of older employees for the new jobs, therefore, these job demands must be considered in relation to the process of aging.

Opinions of Personnel Officials

Personnel officials at the offices visited expressed opinions both favorable and unfavorable to the selection and retraining of older employees for new jobs.

A widely held opinion was that older employees tended to be less adaptable to change than younger employees. Some phrases used in describing this trait were "lack of flexibility," "inability to adapt to new concepts," "slower to learn." Officials who held this opinion were disinclined to employ older persons in this new field of work.

Older employees also were at some disadvantage because of their lower level of education. Some differences among age groups inevitably result from long-term social changes. Opportunities for higher education have been more abundant since the end of World War II than they were earlier.

An important factor favorable to older workers was their attitudes toward work. Many personnel administrators at the offices surveyed believed, on the basis of their experience, that mature and older individuals, on the whole, have a greater sense of responsibility toward their jobs than do younger workers. Comments emphasized the favorable attributes of older workers reported in other studies. ^{13/} Thus, the factors cited as favorable to the retraining of older persons were "their reliability," "care for details," "mature judgment." Their low rate of absenteeism was also noted. While some attention was always given to these traits, either explicitly or implicitly, in assessing job applicants, some officials gave significant weight to these qualities in selecting and retraining employees for the new positions.

^{13/} See Counseling and Placement Services for Older Workers, Bureau of Employment Security, U.S. Department of Labor (September 1956), p. 8.

Brief case histories illustrate how some offices which gave weight to experience and maturity, successfully trained men and women, 45 and over, and assigned them to various positions in this new field.

A correspondent in a large insurance company, age 47, with 28 years of service and a high school education, was transferred to work as a programmer in electronic data processing. His weekly salary was increased from \$129 to \$162.

An accountant in a public utility, age 51, with 3 years of high school and 31 years of service was promoted from his position paying \$500 a month to that of methods analyst at \$690 a month.

A 48-year-old woman in an insurance company, who had 23 years' service and a high school education, was promoted from her position as section head of clerical group, paying \$4,680 a year, to programmer at \$5,824 a year.

A cost correspondent in an insurance company, age 46, with 24 years' service and 2 years of college, was promoted from his \$112 a week job to assistant console operator at \$144 a week.

A 49-year-old supervisor in the Valuation Division of an insurance company, with 29 years service and 3 years of high school, was made a supervisor of computer operations, with a raise from \$7,200 to \$8,600 a year.

A claims examiner in an insurance company, age 45, with 26 years of service and a high school education, was promoted from his position at \$5,824 a year to electronic console operator at \$7,100 a year.

A 46 year old woman, with 2 years of business school and 30 years in an insurance company, was promoted from procedure analyst at \$128 a week to senior programmer at \$180 a week.

Findings of Research Workers

In addition to the opinions of personnel officials at the companies visited, the conclusions of research workers should be considered. Scientific investigators of the relationship between aging and learning ability emphasize the need for making individual appraisal of employees rather than applying fixed notions about the mental capacity of different age groups.

Some research studies, for example, have shown that, on tests of ability to solve problems and learn new material, there is a wide variation among individuals in each age group. Average test scores are somewhat lower as a rule for older persons but some older persons do better than some younger

persons (as in studies of age and actual work performance). Furthermore, there is some evidence that age differences in scores may be less significant on tests of mental abilities than on tests of other aptitudes, such as manual dexterity or perception. 14/

In contrast with the cross-selected approach, the few research studies on changes in the abilities of particular individuals as they grow older suggest that mental abilities may not decline with age. Some longitudinal studies indicate the possibility of improvement in mental ability with age. 15/ These findings strongly support the need for individual appraisal of employees.

Several investigators also conclude that there are ways of compensating for some of the shortcomings of older persons in learning new skills. Welford found, for example, that in solving problems demanding insight into a mass of data, older persons were able to improve their performance by using notes for tasks that would otherwise have to be carried out mentally. Similarly, attention to the manner of presenting new material and to the circumstances and pace of training makes it possible not only to shorten the training time for middle aged and older persons but also helps to reduce the anxiety that often results in discouraging older persons during instruction. 16/

14/ Preliminary unpublished results from a study of the relation of age to performance on the General Aptitude Test Battery, conducted under the supervision of the Bureau of Employment Security, indicate only slight differences among older and younger age groups in average scores on tests of verbal and numerical aptitudes and general learning ability. For a BLS study of age differences in actual office work performance (not learning ability) see summary article by Ronald Kutscher and James F. Walker, Comparative Job Performance of Office Workers by Age (in Monthly Labor Review, January 1960, pp. 39-43). Also, Jerome Mark, Comparative Job Performance by Age (in Monthly Labor Review, December 1957, pp. 1467-1471).

15/ See W. A. Owens, Age and Mental Abilities, a Longitudinal Study (in Genetic Psychology Monographs, 1953, pp. 3-54). Professor Owens retested individuals with the same test after about 30 years and found an increase in the performance of the group. The importance of such studies is discussed by Nancy Bayley and W. A. Owens in Psychological Aspects of Aging, edited by John E. Anderson (Washington, D. C., 1956), American Psychological Association. pp. 151-157.

16/ See A. T. Welford, Ageing and Human Skill, London, Oxford University Press, 1958, pp. 223, 256, and 277. Also, James E. Birren, Age Changes in Skill and Learning, in Earning Opportunities for Older Workers, edited by Wilma Donahue, Ann Arbor, University of Michigan Press, 1955, pp. 70-73.

Finally, some research workers are cautious about the interpretation of aptitude test results, particularly as they pertain to older workers. ^{17/} Such tests are often considered a way of determining basic abilities despite differences among individuals in formal educational achievements. Since tests frequently draw on book knowledge, it is believed that some bias against the older person who completed his education some years ago remains. The emphasis on speed and a lack of recent experience with tests also tend to penalize the older person.

Summary Evaluation

The tendency to discount the maturity, past experience, and other assests of older employees, as new technological developments are introduced, implies that new barriers may be raised to their promotion and employment. From the evidence presented, however, it is clear that a fixed age limit would exclude some qualified older individuals who could be successfully retrained for the new positions.

In view of the emphasis that offices undergoing technological change place on the need for employees who are adaptable and flexible, it will be necessary to give more study to the learning capacities of middle-aged and older persons. Research now suggests that appropriate training methods can increase the adaptability of such individuals. As older employees become more numerous in the labor force, employers will need to find ways of utilizing their skill and ability to the fullest capacity.

^{17/} See Charles Odell, Aptitudes and Work Performance of the Older Worker, (in Psychological Aspects of Aging, op. cit., p. 240).

Appendix A. Unemployment rates, 1954-59

Year	Percent unemployed	
	Experienced civilian labor force	Clerical and kindred workers
1959.....	5.5	3.7
1958.....	6.8	4.4
1957.....	4.3	2.8
1956.....	4.2	<u>1/</u> 2.4
1955.....	4.4	2.6
1954.....	5.6	3.1

1/ Data for 1954-56 are based on data for 4 months and on a slightly different definition of unemployment.

Source: U. S. Bureau of Labor Statistics.

Appendix B. Provisions of union contracts relating to reassignment of physically impaired employees

Agreement A

In the case of a regular employee who has given long and faithful service and who is unable to carry out his regular work to advantage, the company will attempt to place such an employee on work which he is able to perform. In such cases, the other provisions of this article shall not apply (i.e., on seniority), and the employee shall be accorded seniority on his new job equal to that which he had on the job classification he left if he is transferred to an equal or lower job classification.

Agreement B

An employee with twenty-five (25) or more years of service with the company, who cannot thereafter perform his regular duties due to some physical condition or other impairment, and is assigned to a work function which he is capable of performing, shall, for the duration of his employment by the company, retain the same job title and continue to receive the same rate of compensation as theretofore, regardless of the range of pay attaching to the job classification for such work function, but shall not be eligible for wage increases beyond the maximum rate for that work function which he is performing.

Appendix C. Excerpt from International Labor Organization Report

(The following paragraphs are taken from the conclusions of the Subcommittee on the Effects of Mechanization and Automation in Offices, of the International Labor Organization's Advisory Committee on Salaried Employees and Professional Workers, which held its Fifth Session in Cologne, Germany, November-December, 1959. The Subcommittee was composed of 51 members, i.e., 17 from each of the three groups: government, employers, and workers. The Subcommittee adopted the conclusions unanimously.)

1. The application of mechanization and automation in offices has to be recognized as an inevitable development in the search for improved methods and increased efficiency. Advantages have already resulted from the new techniques and these advantages should be of benefit to the whole community.

2. The development of office technology is taking place under conditions and to an extent varying considerably between countries, industries and undertakings. In some countries mechanization is just beginning, in others it is well developed.

3. Office automation is still in its infancy, even in those countries and companies which are farthest advanced. The actual state of development is such that it is difficult to determine with certainty and precision what the consequences will be on the social plane.

4. Therefore, the International Labor Organization could play a most useful role in bringing together the results of experiences acquired by certain countries and disseminating information about these results to all member countries.

5. For various reasons, the introduction of automation in offices has thus far not brought about any significant dismissal of personnel nor resulted in a decline in the general level of employment of office workers.

6. The introduction of office automation has generally occurred during periods of a high level of economic activity. Its introduction in an undertaking takes place over a long period of time, sometimes as much as 3 years for the first application, so that it has been possible to give careful consideration to the potential effects on the staff. In some cases, automation has made new information available and this has led to increased job opportunities.

7. Nevertheless, it is not possible to be categorical about the future effects of mechanization and automation, and it is desirable to give some consideration to problems which may arise.

8. The level of employment may be reduced, at least for a time, in the specific units in which automation is introduced. The dismissal of employees in these units can be minimized, if not completely avoided, by the following

types of action, some of which have been followed by undertakings which have introduced office automation:

- (a) planning conversion operations well in advance in order that changes can be introduced into the organization with a minimum amount of confusion, dislocation or displacement of the working force;
- (b) introducing automatic procedures at a sufficiently slow pace to permit the organization and the workers to assimilate the new routines;
- (c) employment in another branch of the same undertaking while maintaining acquired rights;
- (d) transfer to another locality within the same undertaking with the payment of costs of moving and rehousing, where such costs are incurred;
- (e) suspending or limiting the recruitment of new personnel during the transition period;
- (f) encouragement of retirement of older workers, if adequate pension systems exist;
- (g) advance notice to employees of the impending changes and, if the occasion arises, assistance in finding employment in other undertakings, including the notification of public employment agencies.

9. Because of problems of possible redundancy in an undertaking, and because automation is still in a pioneering stage, special attention needs to be given to training. Facilities for vocational training may need to be provided for personnel in order that they may acquire the knowledge and qualifications necessary for the new functions. For older employees, particularly engineers and technicians, it may be desirable to organize courses to keep them up to date with the latest technical progress. Training may also be needed for those workers who are transferred to other jobs which already exist in the undertaking. Facilities for this kind of training might include, where appropriate, provision for time off and financial assistance.

10. Mechanization and automation in offices bring about changes in occupational structure and in the kinds of skills needed for office work. However, since automation is still in a pioneering stage the changes already introduced may undergo further modification.

In view of this probable evolution it is desirable that forecasting studies be developed both through government initiative and private efforts in order to determine as exactly as possible, both on a short and long-term basis, the scope and pace of these modifications.

Vocational guidance of young men and women towards the various categories of office employment should be carried out, taking account of their personal aptitudes and the results of the forecasting studies, in order to

avoid technological unemployment and to render as infrequent as possible the necessity for recourse to occupational readaptation during their career.

Teaching and vocational training programmes should be revised and adapted continually so as to take into account the new knowledge and qualifications which the automation and mechanization of office work will require of an ever-increasing number of employees. In addition, it may be advisable to increase the number of technical schools and to adapt the curriculums to the changing requirements of office technology. It is also desirable for individual workers to keep themselves abreast of these changing requirements.

11. It has been found advisable in offices, where mechanization and automation have been introduced, to pay attention to the working conditions, such as: (a) appropriate medical supervision; (b) adequate hygiene, heating, lighting, ventilation and cleaning; (c) arrangement of workplaces, particularly in respect of the elimination or reduction of noise; (d) suitable arrangement of hours of work and rest periods, it being understood that if it is necessary to work in successive shifts, nightwork should, as far as possible, be avoided.

12. In cases where transfers of staff require that workers be temporarily placed in lower grade jobs, they should not at the same time experience any financial disadvantage.

13. In general, present or foreseeable conditions make consultation advisable between the interested parties: workers, employers, workers' organizations, employers' organizations; this consultation would take place in accordance with the usual practices in each country. The subjects which might be covered by such consultation would include: (a) information about plans for the introduction of automation in an undertaking; (b) changes in job classification, remuneration and career prospects; (c) the effects of the application of the new techniques on conditions of work.

14. In a broader perspective, the spread of mechanization and automation in offices may have certain general social repercussions which call for action on a national scale, in regard, for instance, to reforms of education and vocational training along the lines outlined in paragraphs 9 and 10 above, general measures for the maintenance of a high level of employment, and possible adjustment of social security provisions. While such measures fall within the competence of government authorities, they should be taken in consultation with the employers and workers concerned, in accordance with national practice. The full cooperation of employers, workers, and public authorities is essential in order to ensure that the transition to automation on a broad scale takes place in an orderly manner, and that the benefits are shared by society as a whole.

Source: Report of the United States Government Delegates to a meeting of the International Labor Organization. The Fifth Session of the Advisory Committee on Salaried Employees and Professional Workers, Cologne, Germany, November 23-December 4, 1959. U.S. Department of Labor, Washington, 1960.

Appendix D. Reassignment procedures and time schedule followed in a large insurance company

- (1) In October 1953 (9 months before the first equipment was installed), the Actuarial Division established an approximate timetable for the conversion of its classification work to electronic procedures. That timetable covered the 18-month period from January 1, 1954, to June 30, 1955. It was, of course, necessary to revise it from time to time, but it did serve as a very useful guide.
- (2) In January 1954, meetings were held of representatives of actuarial and personnel divisions. These were for the purpose of identifying the work areas and personnel that would ultimately become involved. Discussed were such items as the number of persons affected, their job levels, general company experience, length of service, skills, sex, rate of release, etc.
- (3) In April 1954, the senior officer of the personnel division personally met with the persons whose work would be directly affected. He told them what was being planned, the effect that it would have on them, and gave them full reassurance of fair treatment.
- (4) Almost immediately thereafter a representative of the actuarial division personally interviewed each employee involved and prepared a rather detailed biographical sketch. This included the usual information with respect to appointment dates, job levels, salary, skills, job history, educational background, etc. However, it also included two very important special items--(1) The employee's job preferences as expressed by the employee himself, and (2) The interviewer's appraisal of the employee, with special reference to any possibilities of the development of a "problem case."
- (5) A little later a representative of the personnel division had similar interviews with all of those employees who appeared to be placement problems. This, on the surface, might seem like an unnecessary duplication, but we felt it wise to have it done in order that someone in the personnel division might be more personally familiar with these individuals than is possible when working exclusively from a record. This proved to be a very great help especially in connection with those employees who later were assigned to other areas of the company.

- (6) At about the same time, the personnel division held a series of meetings with Management representatives throughout the home office; apprised them of the surplus developing in the actuarial division and requested each representative to review his work units to determine how many such employees might be taken, at what classifications, when, what skills would be needed, etc. These reports were carefully studied in the personnel and actuarial divisions, and an attempt made to make a tentative reassignment of individuals to positions then open or to be made available in the near future. The actual placement of persons began about February 1, 1954, and the whole operation was substantially terminated by September 1955.

Source: Memorandum from company personnel office.

Appendix E. Principles established by a large insurance company to guide the reassignment of employees affected by electronic data processing

I. Double Displacements Should Be Avoided.

Consideration will be given to future plans for any unit to which a surplus employee is to be assigned so as to avoid, insofar as possible, placement in a section, or in a position, which is likely to be abolished. Should a surplus nevertheless occur in a unit following such placement, a second displacement is to be avoided, if possible, by the transfer of others not previously displaced.

II. When a Complete Unit (Division Or Section) Is To Be Abolished, All Employees in the Unit Are To Be Considered as Surplus.

As of an advance record date, the names of all occupants will be recorded and any transfers (including those within the division or department) are to clear through the Surplus Placement group in the Personnel Division. Efforts will be made to place the least adaptable employee in related divisions or sections, reserving the most adaptable for placement elsewhere, if necessary.

The purpose of this arrangement is to avoid disturbing, insofar as possible, long-service employees who are generally less adaptable to change with respect to both work factors and associates; to avoid protracted training, discouragement and possible failure of the less competent employees by placing them in work having as many familiar factors as possible; and to reduce the problems involved in placing higher level employees. The same general procedure will apply when only selected positions within a unit are to be discontinued.

III. When a Large Group Is To Become Surplus at One Time, or Over a Short Period, a Proportionate Allotment May Be Made to All Divisions in Which the Development of a Major Surplus Is Not Anticipated.

This method, which may create a temporary surplus in other divisions, will be used only when the surplus cannot be managed by other means. An impartial distribution will be arranged with the respective divisions by the Surplus Placement group in the personnel division.

IV. Assign Surplus Employees Temporarily to Special Projects

The conversion of records prior to the installation of an electronics system, postponed or deferred work, and other temporary projects may be utilized for this purpose. This method will be utilized only if other placement opportunities are inadequate. Employees so assigned will be transferred to permanent assignments as quickly as possible. If additional employees become surplus they are to be rotated into such work

to replace and release those assigned earlier. Such work will generally be discontinued, or assigned to new employees, as soon as the surplus employees can be placed in permanent assignments.

V. Avoid Unduly Retarding Promotions for Others in the Unit by Creating Additional Higher Level Openings as Needed to Absorb Surplus.

The following means should be considered:

- a. Temporarily increase the number of higher level occupants on existing positions and offset with vacancies on lower level positions in the unit. Divide the lower level work among the higher level occupants until such time as the surplus is eliminated.
- b. Assign female employees to higher level positions traditionally occupied by males, whenever practical.
- c. Increase the number of supervisors, where appropriate, and assign a portion of each supervisor's time to the handling of the more difficult work assignments of the unit.
- d. Review the organization of each unit to provide additional supervisory positions where the present units supervised are larger than optimum size.

VI. Reduce for a Reasonable Period in Advance (Possibly 6 Months) the Numbers of Employees in Those Higher Level Positions Which Will Be Abolished.

This may often be accomplished by replacing higher level employees by employees at lower levels who are assigned only the more routine and simple parts of the work.

Source: Memorandum from company personnel office.

Appendix F. Titles used and duties of six types of electronic data processing positions at companies studied

Analyst, methods or systems

Titles used. Actuarial assistant, data processing engineer, electronic research analyst and planner, junior procedures analyst, junior systems analyst, procedures analyst, project analyst, senior procedures designer, senior systems analyst, systems designer, systems planner.

Duties. Examines existing system of operating unit. Modifies and adapts system to electronic data processing, outlining plan for programming operation.

Auxiliary equipment operator

Titles used. Accounting clerk III, accounting machine operator, assistant operator, computer tape changer, EDP machine operator, electronic auxiliary machine operator, machine system trainee, machine technician, peripheral operator A or B, tabulating control clerk, tape clerk.

Duties. Operates input and output equipment, such as printers, converters, and associated machines, which are a part of the electronic computer system. May also serve as tape librarian.

Console operator

Titles used. Assistant chief operator, EDP machine operator A, electronic computer technician, electronic console operator, junior system operator, senior operator, supervisory control operator, system operator.

Duties. Operates computer console. May supervise auxiliary equipment operators.

Programmer

Titles used. Computer technician, EDPM programmer, EDPM programmer trainee, electronic research analyst, junior electronic research analyst, junior procedures engineer, junior programmer, senior EDPM programmer, senior programmer.

Duties. Diagrams program for application to computer system in accordance with recommendations of analyst. Converts program instructions into machine "language" or codes and tests new programs.

Programmer-analyst

Titles used. EDP programmer analyst, job specifications analyst, methods analyst, programmer, senior programmer analyst.

Duties. Engages in a combination of the duties indicated above for the analyst and programmer jobs.

Tape librarian

Titles used. Librarian

Duties. Receives, files, catalogs, maintains, and issues magnetic tapes to electronic machine operators, as required.

Source: Based on position descriptions used at offices visited.

Appendix G. Provisions of union contracts relating to the setting of wage rates for new positions in electronic data processing

Contract A

In the event that a new job or position is established or there is a substantial change in the duties or requirements of an established job, the company shall develop an appropriate job description and establish within the existing rate structure provided in section 2 of this article the basic rates to apply to such job. The company shall furnish the union with the new job description and shall submit for its approval the rate established for such job. In the event that agreement is not reached within seven (7) calendar days from the date of such submission or within such additional time as may be mutually agreed upon, the company may place the new job description and rate in effect, subject to continued negotiation of the rate. Within five (5) working days from the date the job is placed into effect, the union may proceed in accordance with Step 3 of the grievance procedure established in article III, section 1 of this Agreement.

In the event agreement on the rate range for the newly established job is not reached by the Labor Relations Committee, either party may refer the matter to arbitration in accordance with the provisions of article III, section 4 of this agreement. The arbitrator shall have the authority to determine the proper position of the new or amended classification within the existing agreed upon rate structure on the sole basis of the relationship the new or amended job bears to the other jobs in the existing rate structure. Any change in the established rate resulting from the negotiations shall be retroactive to the date such rate was placed in effect.

Job descriptions shall be applied in accordance with the Supplement attached hereto and entitled, "Joint Statement of Policy for Application of Job Descriptions."

Contract B

Whenever it is necessary to establish job classifications which may fall within the scope of this Agreement, rates of pay for such classifications shall be conformed to the rates of pay established by this Agreement for existing positions of similar rank, class, and job content. If no similar classifications exist for comparative purposes, the company shall determine the ranking of the new classification. If the brotherhood is of the opinion that the provisions of this agreement have not been properly applied, its contention may be presented as a grievance under article 33 hereof.

Contract C

When and if from time to time the company, at its discretion, establishes a new job or changes the job content (requirements of the job as to training, skill, responsibility, and working conditions) of an existing job to the extent of one full job class or more, a new job description and classification for the new or changed job shall be established in accordance with the following procedure:

1. Management will develop a description and classification of the job in accordance with provisions of the May 6, 1950, Agreement between the parties hereto.
2. The proposed description and classification will be submitted to the grievance committee for approval, and the standard salary scale rate for the job class to which the job is thus assigned shall apply in accordance with the provisions of subsection B of this section.
3. If management and the grievance committee are unable to agree upon the description and classification, management shall install the proposed classification, and the standard salary scale rate for the job class to which the job is thus assigned shall apply in accordance with the provisions of subsection B of this section. The employee or employees affected or the grievance committee may at any time within 30 days file a grievance alleging that the job is improperly classified under the job description and classification procedure of the May 6, 1950, Agreement between the parties hereto. Such grievance shall be processed under the grievance and arbitration procedures of this Agreement and settled in accordance with the job description and classification provisions of the aforesaid May 6, 1950, Agreement. If the grievance is submitted to the arbitration procedure the decision shall be effective as of the date when the disputed job description and classification were put into effect.

Appendix H. Steps followed in one large company in selecting employees for electronic data processing positions

- A. A review of personnel records.
- B. A review of the candidates thus selected by local Division Managements who were requested to add other suitable candidates and note those considered unsuitable.
- C. The conducting of group meetings in the respective Divisions with the Managements (usually the Officer in charge) and the prospective candidates. An explanation was given of the opportunities, requirements, and selection procedures and an invitation was extended for anyone interested to apply. A similar invitation was extended to others who had not been invited to attend the meetings.

Incidentally, since many candidates considered were middle aged, and had had no recent schooling, all were assured that if they completed the tests with poor results, this failure could not adversely affect them since the results would not be made known to management. This assurance is believed to have interested many employees in competing for the assignments who would not otherwise have been willing to apply.

- D. The administration of a group of tests to the approximately 250 employees responding affirmatively to the invitation. Three types of tests were used: (1) mental alertness (with subscores for numerical and verbal facility), (2) functional mathematics (selected as a measure of ability to work with numbers and symbols), and (3) mechanical comprehension.
- E. The tabulation of the applicants in test score order, by a slight ranking, giving greatest weight to mental alertness--and second to the test of functional mathematics.
- F. A review from the highest score downward to weed out obvious problem cases or otherwise clearly unsuitable candidates.
- G. A study of the individual case histories of those scoring highest on the tests.
- H. The conducting of personal interviews, and a consultation with employee's present management.
- I. The making of final selections based on all available data, and the review of choices with present officer in charge to obtain release. Notification to individual employees.

- J. A personal letter was sent over the signature of the personnel officer to each employee who completed the tests but was not selected. The letter thanked the employees, explained that no immediate assignment would be made, and invited them to discuss their test results with a member of the staff if they were interested. About 60 percent responded to this invitation and the very favorable general attitude towards the entire selection procedure is believed to have been greatly affected by this step.
- K. After the first group of programmers had been selected and partially trained, the invitation was extended to employees a second time. Nearly 300 more employees applied and were tested, bringing the total to about 550. The purpose of the second invitation was twofold--to accommodate those who had subsequently expressed an interest, and to obtain needed diversification of company experience.

Source: Memorandum from company personnel office.

Appendix I. List of tests used by companies in selecting employees for
electronic data processing positions

- American Council on Education Psychological Examination. Educational Testing Service, 15 Amsterdam Ave., New York 23, N. Y. (no date)
- Aptitude Test for EDPM Programmers. The Psychological Corp., 522 Fifth Ave., New York 36, N. Y., 1955.
- California Test of Mental Maturity. California Test Bureau, 5916 Hollywood Boulevard, Los Angeles 28, Calif. (n.d.)
- Differential Aptitude Tests. Form A. Numerical Aptitudes and Form B. Abstract Reasoning. George K. Bennett, Harold G. Seashore, and Alexander G. Wesman. The Psychological Corp., 522 Fifth Ave., New York 36, N. Y., 1947.
- Foust-Schorling Test of Functional Thinking in Mathematics. World Book Co., 313 Park Hill Ave., Yonkers 5, N. Y. (n.d.)
- Kuder Preference Test. Science Research Associates, 57 West Grand Ave., Chicago 10, Ill. (n.d.)
- Otis Employment Tests 2B. World Book Co., 313 Park Hill Ave., Yonkers 5, N. Y., 1943.
- Personnel Classification Test. Alexander G. Wesman. The Psychological Corp., New York 36, N. Y., 1946.
- Schubert General Ability Battery. Herman J. P. Schubert. 1946.
- Vocational Interest Blank for Men. Edward K. Strong, Jr. Stanford University Press, Stanford, Calif., 1938.
- Watson-Glaser Critical Thinking Appraisal (Form Am.) Goodwin Watson and Edward Maynard Glaser. World Book Co., Yonkers 5, N. Y., 1951-52.
- Wonderlic Personnel Test. E. F. Wonderlic. P.O. Box 7, Northfield, Ill. (n.d.)

Appendix J. Selected Annotated Bibliography

A. Impact of Electronic Data Processing on Office Employees1. Department of Labor Publications.

Automatic Technology and Its Implications--A Selected Annotated Bibliography. Bull. 1198, Bureau of Labor Statistics, Washington, 1956. 78 pp.

More than 350 references on the operations of automated equipment in business and industry, and the implications for labor, management, government, and the economy.

Automation and Employment Opportunities for Officeworkers. (Occupational Outlook Series--Bull. 1241). Bureau of Labor Statistics, Washington, 1958. 14 pp.

Vocational implications of electronic data processing equipment for clerical personnel. Discusses the training required, earnings, and employment outlook for the newly created occupation of programmer.

A Case Study of an Automatic Airline Reservation System. Report 137, Bureau of Labor Statistics, Washington, 1958. 21 pp.

Report on the introduction of an electronic system of processing passenger reservations at a large airline. The process of making the change and its implication for employment, job content, and job assignments. Attitude of management and employees toward the change.

The Introduction of an Electronic Computer in a Large Insurance Company. Bureau of Labor Statistics, Washington, 1955. 18 pp.

A case study of methods used to plan for and implement a conversion to electronic data processing. Effect on operations and employment, reassignments, job content, and training requirements.

Occupations in Electronic Data Processing Systems. Bureau of Employment Security, Washington, 1959. 44 pp.

Job description of 13 key occupations, qualifications, and process flow.

Report of the United States Government Delegates to a Meeting of the International Labor Organization. The Fifth Session of the Advisory Committee on Salaried Employees and Professional Workers. Cologne, Germany, November 23-December 4, 1959. Washington, 1960.

Contains the report of the Subcommittee on the Effects of Mechanization and Automation in Offices.

2. Other Government Publications

Personnel Impact of Automation in the Federal Service. U.S. Civil Service Commission, Bureau of Programs and Standards, Washington 1957. 21 pp.

Results of a study to ascertain the status of major technological changes in Federal operations. Identifies personnel problems and needs, and provides a basis for further action.

Automation and Technological Change; Hearings. Joint Committee on the Economic Report, Congress of the United States (84th Cong., 1st sess.), October 14-17; 24-28, 1955.

Statements by Robert W. Burgess, U.S. Bureau of the Census; Ralph Cordiner, General Electric Corp., and Howard Coughlin, Office Employees International Union, on office automation.

Automation and Recent Trends; Hearings. Joint Economic Committee. Congress of the United States (85th Cong., 1st sess.), November 14-15, 1957.

Statements by Everett J. Livsey and A. R. Zipf, of Bank of America on application of electronic data processing to banking operations.

Office Automation and Employee Job Security; Hearings. Subcommittee on Census and Government Statistics of the Committee on Post Office and Civil Service. House of Representatives (86th Cong., 2nd sess.), March 2 and 4, 1960.

Personnel policies and experiences of government offices.

Use of Electronic Data-Processing Equipment; Hearing. Subcommittee on Census and Government Statistics of the Committee on Post Office and Civil Service. House of Representatives (86th Cong., 1st sess.,) Washington, June 5, 1959.

Surveys of impact of electronic data processing in Federal Government.

3. Periodicals and Books

Allen V. Astin. How Will Automation Affect the White-Collar Worker? Labor Looks at the White-Collar Worker. (In Proceedings of a Conference on Problems of the White-Collar Worker sponsored by the Industrial Union Department, AFL-CIO, Feb. 20, 1957, pp. 45-53.)

Evolution and growth of office automation. Implications for employment, skill requirements, and utilization of office workers.

Automation and Society. Edited by H. B. Jacobson and J. S. Rousek. New York, Philosophical Library, 1959.

Case study of office automation by David G. Osborn.

E. R. Becker and E. F. Murphy. The Office in Transition. (New York, Harper and Bros., 1957), pp. 99-148.

Problems of employee communication about a conversion to EDP. Interviews, questionnaires, and tests as aids in selecting employees. Role of training programs. Human relation problems during the transition. Benefits of office automation.

F. H. Bergtholdt. Selecting and Training Personnel for the EDP Team. In Electronics in Action, Special Report No. 22. (New York, American Management Association, 1957), pp. 51-59.

Methods used by a large food processing company to select and train employees for electronic data-processing jobs. Interviews, tests, and on-the-job training assignments as selection methods.

A Bigger Role for the Clerks? (In Railway Age, July 29, 1957, pp. 19 ff).

Union's (Brotherhood of Railway Clerks) policy toward the introduction of electronic computers in the railroad industry.

Harold Farlow Craig. Administering a Conversion to Electronic Accounting; A Case Study of A Large Office. Division of Research, Graduate School of Business Administration, Harvard University, Boston, Mass., 1955. 224 pp.

Management policies in installing new office equipment in a life insurance company. Employee attitudes and adjustments.

Effects of Mechanization and Automation in Offices: I. (In International Labor Review, February 1960, pp. 154-173.)

Based on ILO Report. Covers effects on employment.

J. Douglas Elliot. Will Electronics Make People Obsolete? (In The Impact of Computers on Office Management, Office Management Series, No. 136.) (New York, American Management Association, 1957.) pp. 47-60.)

Misconceptions concerning the effects of electronic data processing on job security. Employee relations problems at a large utility company.

Establishing an Integrated Data-Processing System. (New York, American Management Association, 1956). pp. 100-118. Special Report No. 11.

Human problems involved in converting to integrated data processing. Selecting, training, and evaluating employees. Potential of older employees for IDP jobs.

Charles E. Ginder. Why Automation? (Willow Grove, Pa., National Office Management Association, 1959).

Report on survey of uses of electronic and integrated data processing. Includes bibliography on office automation.

Eugene Jacobson, et.al., Employee Attitudes Toward Technological Change in a Medium Sized Insurance Company, (in Journal of Applied Psychology, December 1959,) pp. 349-354.

Study of the introduction of a computer.

Man and Automation. Report of the Proceedings of a Conference sponsored by the Society for Applied Anthropology at Yale University, December 27-28, 1955. (New Haven, Yale University, 1956).

Papers by Floyd C. Mann, J. A. Littel, Sylvia Carter, and Walter H. Johnson and Kenneth G. Van Auken on experiences in introducing electronic data processing in offices.

Men, Machines, and Methods in the Modern Office. (New York, American Management Association, 1958). Management Report No. 6.

Papers by H. W. Prentis, Jr., Devereux C. Josephs, and Virgil K. Rowland, on problems of gaining employee support through better communications.

Floyd C. Mann and Lawrence K. Williams. Organizational Impact of White-Collar Automation. In Proceedings of Eleventh Annual Meeting of Industrial Relations Research Association, Chicago, IRRA, 1958.

Effects of electronic data processing on industrial relations and personnel.

Pioneering in Electronic Data Processing. (New York, American Management Association, 1956). Special Report No. 9.

Papers by F. J. Porter, Jr. and Wesley S. Bagby, on problems of reassigning, training, and selecting personnel in a public utility and insurance company.

Georgina M. Smith. Office Automation and White-Collar Employment. (New Brunswick, Rutgers University, Institute of Management and Labor Relations, 1959), Bull. 6, 26 pp.

Covers employment effects and new working conditions.

Jack Stieber, Automation and the White-Collar Worker. (In Personnel Magazine, November-December, 1957, pp. 8-17.) (Also reprinted by the Labor and Industrial Research Center, Michigan State University, 1957-58 Reprint Series.)

Effect of office automation on employment, occupational distribution, job opportunities, employee attitudes, unionization, and management. Comments on research findings from several case studies.

Robert E. Slater. Thinking Ahead: How Near Is the Automatic Office? (In Harvard Business Review, March-April, 1958, p. 27 ff.)

Personnel and organizational problems associated with automating clerical functions. Problems of employee training, job evaluation, and salary administration. Planning the change--reorganizing work procedures and the physical plant.

C. Edward Weber. Impact of Electronic Data Processing on Clerical Skills. (In Personnel Administration, January-February, 1959, p. 20).

Two case studies of offices in industrial plants.

B. Special Problems of Older Office Employees

Earning Opportunities for Older Workers, (Ann Arbor, University of Michigan Press, 1955).

Papers by Helen H. Randall and John W. Travis on employer attitudes toward utilization of older office employees.

Employment of Older Workers in Office and Professional Occupations. Age Barriers to Employment. (In Proceedings of the Older Worker Conference--1958, sponsored by the Commonwealth of Pennsylvania, Department of Labor and Industry at Philadelphia, Pa., May 15-16, 1958.) (Harrisburg, Department of Labor and Industry, 1958), pp. 120-130.

Panel discussion on the opportunities for, and obstacles to, the employment of older workers in office and professional occupations.

Hiring Older Workers. (New York, Office Executives Association, 1957.)

Survey of hiring practices in relation to older clerical workers in New York City. Attitudes on performance, turnover, absenteeism.

Milton M. Mandell. Recruiting and Selecting Office Employees. (New York, American Management Association, 1956.) 175 pp., Research Report No. 7.

Description of office occupations. Problems of recruiting and selecting at all levels.

The New Frontiers of Aging. (Ann Arbor, The University of Michigan Press, 1957.)

Papers by Warner Bloomberg, Jr. and James Stern on implications of automation for security of older workers.

Waino W. Suojanen. Supervising Older Clerical Workers. (In Personnel, May-June, 1958, pp. 16-21.)

Problems of supervision resulting from an increasing proportion of older clerical employees. Need to reevaluate traditional methods of supervision. Suggests job rotation and job enlargement as a relief to job boredom.

PUBLICATIONS ON PRODUCTIVITY AND TECHNOLOGICAL DEVELOPMENTS

TRENDS IN OUTPUT PER MAN-HOUR IN THE PRIVATE ECONOMY, 1909-1958 (Bull. 1249, 1959), 47 pp., 50 cents.

Indexes of output per man-hour, output, and employment in major sectors. Analysis of trends and factors affecting changes. Notes on data.

COMPARATIVE JOB PERFORMANCE BY AGE: OFFICE WORKERS (Bull. 1273, 1960), 36 pp., 30 cents.

Compares the job performance of six age groups, including output per man-hour, accuracy, and consistency of performance. Covers 6,000 employees in industry and government.

PRODUCTIVITY: A BIBLIOGRAPHY (Bull. 1226, 1957), 182 pp., \$1.

Covers nearly 900 references to articles, books, papers, pamphlets, and reports on productivity measurement, factors affecting productivity and significance of productivity changes.

STUDIES OF AUTOMATIC TECHNOLOGY: (The following publications are free. See note below.)

Series of case studies of plants introducing automation. Describes changes and implications for productivity, employment, occupational requirements and industrial relations.

- A CASE STUDY OF A COMPANY MANUFACTURING ELECTRONIC EQUIPMENT.
- THE INTRODUCTION OF AN ELECTRONIC COMPUTER IN A LARGE INSURANCE COMPANY.
- A CASE STUDY OF A LARGE MECHANIZED BAKERY (BLS Report 109).
- A CASE STUDY OF A MODERNIZED PETROLEUM REFINERY (BLS Report 120).
- A CASE STUDY OF AN AUTOMATIC AIRLINE RESERVATION SYSTEM (BLS Report 137).

Publications may be purchased from the Superintendent of Documents, Washington 25, D.C. Free publications are available from the Bureau of Labor Statistics, U.S. Department of Labor, Washington 25, D.C.