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THE EFFECT OF AUTOMATION ON ACCOUNTING JOBS

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THE EFFECT OF AUTOMATION ON ACCOUNTING JOBS

CHAPTER I

THE PROBLEM

Introduction

Accounting, as a major office function, has long ceased to be a simple process of recording, posting, and analyzing business transactions. In the past 15 years of war and postwar production, management has come to recognize the increasing significance of cost accounting and other financial controls in the successful operation of business enterprises.

Accounting has become complex, fast-moving, and pivotal as a facet of management decision-making. It is today the basis upon which an efficient modern business functions. To keep pace with the increasing demands made of accounting departments in business and industry, varying degrees of automation have been introduced. Automation in industrial operations has become vital to continued progress and the future prosperity of American industry. More and more businessmen are realizing also that office mechanization is essential in doing the paper work required by expanding industrial

activity. Automation in the handling of mental as well as material production is the trend in modern business management.

Definition of Automation

The current wide-spread interest in automation is stimulated by demands for goods of uniformly high quality, demands for great quantities of accurate business information, and the generally high cost of labor.

Automation has different connotations based on the interests and experiences of the individuals concerned with it. Because automation was first publicized in connection with manufacturing processes, much of the language used in defining it involves factory terminology.

Some authors describe automation in terms of three separate processes: the "Detroit" process,¹ feed-back control process,² and the computer process.³ This approach concentrates on accomplishing specific industrial tasks through one of these processes alone, not as a combination of the three. Other authors approach automation on three machine levels: dependent machines, semi-automatic machines,

¹The "Detroit" process involves integrating machines with one another to give a continuous flow of production of materials.

²The feed-back control process involves the use of electronic control in regulating the operations of production. This factor operates in the same manner as the thermostat that controls room temperature.

³The computer process involves the use of data-processing equipment in recording, tabulating, and analyzing data.

and automatic machines. Here the indication is that machines are the key to automation, and their dependence on human operation establishes the degree of automation. A third approach to describing automation is that it is not one thing but a combination of several--computer technology, continuous processing¹ or integration,² and feed-back control. In this approach each of the separate areas of automation are tied together as a system for material and/or data processing.

Alfred Kuhn in his book Labor: Institutions and Economics, in discussing automation, states that computer technology "is the only aspect of automation which is distinctly new, the others being mainly the extension of new areas and through new devices of principles long in use, plus the fact that simultaneous and concentrated attention is focused on all these principles."³

Even though these early interpretations of automation pertain to factory production, very similar techniques are used in office production, the differences occurring primarily in the materials processed. It should be noted that

¹Continuous processing is mainly restricted to manufacturing of liquid or semi-liquid materials or raw materials that can proceed through the manufacturing process through gravity or forced feeding.

²Integration usually deals with solids which must be handled as individual units through the manufacturing process.

³Alfred Kuhn, Labor: Institutions and Economics, (New York; Rinehart and Company, Inc., 1956), p. 497.

industry processes three things--matter, energy, and information. Business offices are the information processing units and the memory centers for the large volume of paper work required in today's industrial operations.

For the purpose of this study and in terms of the author's analysis of the literature, automation is defined as the continuous and integrated operation of data processing through the use of automatic machines.

Automation in the Accounting Process

Accounting is described as the recording, classifying, summarizing, and interpreting of data of a financial character; therefore, the chief functions of the accounting department are the recording and reporting of data from business transactions for management's use.

Through the recording function, a reservoir of office information is established so that such information will be available when needed. The reporting function involves processing the office information for use by all levels of management. The reporting function is accomplished by means of manipulating the data accumulated in the memory reservoir.

To accomplish the two primary accounting functions, there are five processing stages involving information coming into or going out of a business office:

1. The information is placed in a category.
2. Each item is given a designation within the category.
3. The item of information is acted upon.

4. The actions are totaled.
5. The information is recorded.

The flow of paper work through these five stages, whether the record keeping system is maintained manually or with the aid of machines, is accomplished by means of seven basic clerical functions:

1. Preparation of source documents.
2. Introduction of in-put data from these documents into the accounting system.
3. Manipulation of the data--assembling, sorting, and classification; reference to and extraction of related data previously stored; and computation.
4. Storage of data, including temporary filing of intermediate results and other data in process and the maintenance of files of carry-forward data.
5. Out-put of results from processing.
6. Summarization of results.
7. Supervisory control.¹

In performing more or less automatically the various accounting functions, four levels of automation in the accounting routine can be isolated. The first level of automation involved in accounting is the duplication of data through the use of carbon paper or other duplicating processes. To illustrate, such source documents as sales slips, bank deposit slips, purchase requisitions, and other business papers prepared with pencil or on the typewriter are usually duplicated for further processing. At this level, the recording function of the business office has been automatized to a limited degree.

¹Data Processing by Electronics (New York: Haskins and Sells, 1955), p. 9-10.

The second level involves more extensive utilization of certain office machines. Adding machines, calculators, and posting machines increase the degree of automation as they are used to complete basic arithmetical processes with greater speed and accuracy than is possible by means of "paper and pencil" calculations.

The third level of automation relates to the use of punched-card or tape equipment which permits extensive mechanization of the processing sequence of accounting data. At this level, following manual entry into the punched card or tape, the recording and/or reporting of accounting data are handled mechanically.

The top level of automation in the office today utilizes high-speed electronic data-processing equipment and computers. Raw data taken from source documents--once entered on punched-card or tape input devices--can now go through the entire gamut of accounting functions within a machine. The output at this level is information on a printed report, a punched card, or a tape ready for further processing.

There is much evidence that the development of automatic data-processing equipment is currently playing a vital role in narrowing time gaps in the solving of management problems and in processing business information to facilitate decision making by management.

It is with the third level of office automation that this study is primarily concerned. This is true because it is punched-card equipment that is commonly used in the business and industrial activities in the geographic area with which this study is concerned.

Technological Development and Business Employment

Technological development has been the key to the evolution of industry from hand methods to the current mechanized and sometimes automatic methods. To certain individuals and groups, automation is a "mechanical monster" which threatens to destroy industry. To others, automation promises to be the answer to most of the factory and office production problems of business and industry. Between these two extremes, there are many attitudes relative to automation. The individuals directly associated with and carefully studying the field of automation agree that there will be many changes in our society as a result of automation. The basic fears of and hopes for automation today are similar to those that prevailed during the industrial revolution and the period of extensive mechanization which followed.

Because mechanization and automation ultimately reduce the amount of time and labor required in accomplishing certain business and industrial processes, the question of technological unemployment looms as a major problem. Uninformed individuals, speculating about automation, frequently

ask the question: "Are people going to become obsolete?"

T. R. Pleim, a management consultant specializing in automatic accounting devices, says:

Actually, electronic data processing systems are needed to forestall a serious shortage of adequate clerical help. The productivity of clerical workers has not kept pace with the increasing productivity of our industries, and a continuously increasing ratio of clerical to production workers has been required to meet the information needs of business and government. The computer system will increase the productivity of our clerical force and partially offset this trend.¹

In the past, as machines have replaced men on the production lines, the human energy so released has been in a large measure absorbed by an expansion of employment in such wage-earning activities as those connected with electronics, aeronautics, communications, entertainment, travel, and personal service. It is also interesting to note that a significant number of the replaced individuals have been employed in the production of equipment for automation itself.

Automation has three significant implications for skilled labor:²

1. Certain existing skills will be rendered obsolete.
2. Certain existing skills will be diluted by further division of labor.
3. There will be a demand for new skills, usually at a higher level.

¹Theodore R. Pleim, "End of an Era," Systems Magazine, XX (September-October, 1956), p. 13.

²W. S. Buckingham, Jr., Implications of Automation, Congress of Industrial Organizations Conference on Automation, Washington, D. C., April 14, 1955.

It appears that automation in any particular instance ultimately results in an up-grading of the labor force. Routine and uninteresting jobs are eliminated and more responsible and challenging jobs are created. There is much evidence to indicate that automation results in a demand for highly skilled personnel capable of maintaining the complex and costly equipment. It is predicted that in the near future the ratio of managers to employees will increase substantially as expensive equipment is utilized and the scope of each work process is enlarged.

Statistics compiled by the United States Department of Labor indicate that the unfilled demands for skilled workers for 1957 increased 17 per cent over 1956 as compared with a 9 per cent increase in the number of other workers required. Labor Secretary James Mitchell has estimated that by 1965, approximately 5,000,000 more skilled or semi-skilled workers must be added to the 9,000,000 skilled workers now employed in the United States.¹ One of the significant factors that caused the current shortage in skilled manpower is the increased productivity of machines in the factory and in the office. This increasing productivity is a direct result of the extension of mechanization and automation.

The question of whether technological development permanently reduces the total amount of employment in an

¹"The Shortage in Skills," Time, LXXI (May 20, 1957), p. 114.

economy is quite different from the question of whether it causes unemployment of particular people at a specific time. There is evidence to indicate that in general technological developments do not increase the total amount of unemployment over a period of time, but that such development sometimes causes temporary unemployment for specific groups of people. The problems of re-educating and re-locating employees in general and even within individual companies probably will not be as significant as many persons believe. When an automated process is applied in an office, certain jobs are generally eliminated. The workers in these jobs are replaced by machines; however, the people may be absorbed in other areas where shortages exist, or they may be re-educated so that they can be utilized in the automated unit. In automation, as in the case with other technological advances, new jobs are created through change. New professions in "data processing" are coming into being to cope with the problems of automation in the business office. Systems analysis and design, programming and the reworking of present applications, and the improving of these applications are currently required additions to the accounting staff rather than a decrease.

Automation will require a more drastic adjustment than mechanization because of the up-grading of the labor force. Because of their skill attainment, workers displaced through mechanization usually found similar work in the same

industry or in an associated industry using the same skills. The worker displaced through automation generally is the semi-skilled individual who will require training in new skills if he is to be qualified for a new job with his old employer or a new employer. Under mechanization, the semi-skilled worker became dominant in industry. Automation will probably spell his decline. The following quotation illustrates automation's effect on the semi-skilled workers in the office.

Those in repetitive, unskilled and semi-skilled jobs will first feel the impact. Already many typists, insurance clerks and other office and clerical workers are suffering mental indigestion caused by worry of job replacement by machinery.

Actually, the employment picture is far from dismal, for automation, requiring a continuously expanding economy, will create vast new job opportunities.¹

This quotation also emphasizes the theory that technological change does cause temporary unemployment of particular persons at a certain time; but from the long-run standpoint there is increased employment through job opportunities.

Most of the experts in the area of automation indicate an expected increase, rather than a decrease, in the number of people employed. H. V. Widdoes, vice president and general sales manager for Remington Rand Division, Sperry-Rand Corporation states:

Office workers will not be replaced through the use of electronic data processing systems. You can

¹Mary K. Ericsson, "Automation and the Individual," National Business Woman, XXXVI (February, 1957), p. 7.

search the records of every company covering every installation of the Remington Rand Univac, for example, without tracing one job loss to the computer.¹

Machines and automation will not put people out of work but give more people work by creating more jobs. This seems particularly true in office work as shown by the large percentage of increase in office personnel since the introduction of the typewriter. Just 50 years ago few offices were equipped with the typewriter; today, even the smallest office has at least one and in many cases the machines are electric.

Much the same thing can be said for other office machines. Fifty years ago adding machines, calculators, and posting machines were relatively unknown to the accounting office. Tabulating machines, for general accounting use in business and industry, were something for the future. Now all this equipment is considered basic, yet more people are employed in offices and in accounting work today than ever before. This result came about because the machines were not put into use to cut down on the need for accounting personnel but to increase the efficiency of the accounting operation.

The future of accounting appears bright as automatic machines take over the repetitive routine tasks, leaving to people the more interesting work of establishing controls, making decisions, and interpreting results.

¹H. V. Widdoes, "The Significance of Automation," Business Education World, XXXVI (September, 1955), p. 13.

The Future of Office Automation

The future of automatic-data processing has become a subject of vital concern to business executives who are attempting to evaluate their companies' positions with respect to automation in the handling of accounting information. Most experts in the field of office automation agree that the systems now in operation are not being used to the fullest extent.¹ It is interesting to note also that new developments are constantly being made improving on these systems and new equipment is being developed that will do faster and more accurately the jobs performed by the present equipment. Only a few years ago one manufacturer of such equipment considered 50 high speed computer systems as the maximum that American business could use. By the end of 1955 that limit had been raised to 5,000 which was not considered the ultimate maximum. Still another manufacturer predicts that 10,000 large-scale computers will be in use within the next ten years. This indicates that some of the medium-sized businesses as well as the larger ones will be using automatic data-processing equipment in the analysis of their business information.

Automation in the business office is becoming just as vital a tool of industry as automation in manufacturing. Since the basis of the free enterprise system, on which our economy is structured, is competition, the business concern

¹Pleim, loc. cit., p. 13.

that does not move rapidly, thoroughly, and effectively to take advantage of opportunities is soon forced to fall by the wayside. Automatic equipment is designed to do more quickly, more accurately, and in the end more economically much of the record-keeping of the accounting office now being done by hand. To keep pace with other industrial developments, routine record-keeping must be put on an automatic basis. If business enterprises do not take this approach to processing accounting data, it may be that within the next few years there will be an even greater shortage of accounting personnel.

As the population of the United States increases, the need for goods and services increases, causing business throughout the country to become more and more active. The company that once sold five units a day may now be selling thousands of units a day. Because the basic material handled in the office is "information," it follows that as the business grows more complex the need for more and more information increases. To illustrate the increase in the gathering and transmitting of business information which is the office operation, there was a 53 per cent increase in the number of factory workers as opposed to a 150 per cent increase in the number of office workers between 1920 and 1950.

In the industrial revolution, the mechanization of the factory came about because of a need for increased production. Mechanization and automation of the office is

coming about because of the need of management for increasing amounts of information obtained more rapidly, more economically, and with a higher degree of accuracy than can now be made available by hand. It is nearly impossible to keep all the records, prepare all the invoices, order material, prepare cost analyses, and maintain other accounting functions as the volume of business increases without utilizing some degree of automation. The methods used when only five units were involved must give way to more expedient methods. In our economic structure, with the importance placed on competition, the company that can analyze and present business information needed by management in the shortest possible time is eventually the one that will most likely succeed. Wise decisions can best be based on complete accounting data.

Because they can carry out purely mechanical functions much more quickly and accurately than the individual accounting clerk, the machine and automation have become necessities in the accounting office. Automation in accounting is fast becoming the greatest potential for change in business education since 1823, when bookkeeping was added to the curriculum of a high school in Boston.

Most educators and businessmen will agree that the secondary-school business departments have provided adequate preparation for general office workers who in the past have carried out the routine processing of paper work in offices.

Since automation is designed to do more quickly and economically the processing of paper work, its importance to business education is obvious. If the business department is to continue to function in the area of occupational preparation, there must be provision for education for automation. Without it, the business education programs of our educational system cannot keep pace with the rapid advance of automation in the business world.

Automatic processing of paper work in business and industry has far-reaching implications for business education. It may well be that the changes resulting from automation will eventually be as broad in their nature and scope as were the changes which resulted from the use of the typewriter. It appears that the business education curriculum is rapidly becoming inadequate, and perhaps obsolete, in meeting the needs of individuals who are preparing for business occupations in general and bookkeeping and accounting occupations in particular. Businessmen are obviously confused concerning how best to utilize automatic equipment, and business educators likewise are confused in terms of how techniques and procedures for preparing office employees need to be revised.

Statement of Problem

The problem of this study is to determine the nature and extent of the effect of automation on the bookkeeping and

accounting phases of office work and to develop recommendations for essential changes in business education so that the challenges to business education offered by automation may be adequately met.

The data involved in this study are organized to reveal the effect of automatic processing of records and accounting information on personnel, management policies, business costs, and other related factors. In addition, the data are organized to reveal the specific nature of initial job preparation and re-training activities where automatic equipment is utilized.

More specifically, the study is designed to permit the development of recommendations relative to needed changes in the content and procedures of business education if the challenge of automation in the field of accounting is to be properly resolved by businessmen and business educators.

Definition of Terms

Terminology peculiar to the field of automation will be defined in the text of this report or in footnote references at appropriate points. This procedure is followed so that the definitions of the technical terms will be presented at the points where they are utilized in the discussion. A glossary of certain of the terms unique to the field of automation is also presented in Appendix A.

Delimitation

This study is primarily concerned with business firms which have changed from manual to machine methods of accounting during the past ten to fifteen years. The investigation of the operations of users of machine accounting methods will be concerned only with those companies that are now processing accounting data through the use of a partial¹ or a complete² installation of punched-card equipment. The data included in this research study is limited to information obtained regarding machine-accounting installations only in Oklahoma City, Oklahoma.

Sources of Data

Background information required in the organization and development of this investigation was obtained from published materials in the general field of automation. These materials included books, current periodicals, trade journals of manufacturers, and special bulletins of various organizations interested in the automation of accounting processes. The analysis of information and data in the periodicals and trade journals was limited largely to material written after

¹ A partial installation involves a machine unit which completes only a part of the accounting process. The partially-processed accounting data is sent to a service bureau for completion.

² A complete installation involves machine units which complete all phases of the entire accounting process, through the use of company-owned equipment.

1950, because prior to that time only limited interest in office automation was evidenced.

General information about the total use of automatic-machine accounting in the Oklahoma City area was obtained from representatives of the major distributors of punched-card accounting equipment.

The primary data on which this study is based were obtained by means of personal interviews with supervisors of machine-accounting units in a number of businesses using punched-card equipment for the maintenance of accounting records. The data obtained by this means relate to the general nature of each business organization, extent of machine utilization, type of machine accounting system used, specific accounting functions performed by machines, personnel involved, current employment practices, qualifications of employees, and unique problems involved in machine utilization.

Procedure

The procedure for completing this study involved the use of the library and case-study methods of research. The following steps were involved:

1. An extensive review of published material in the field of automation was made to gain essential background data, information about automatic systems, and insight into automation from the points of view of businessmen and business educators.

2. Business concerns using machine methods in their accounting departments were located through interviews with major distributors of punched-card equipment in the Oklahoma City area and an analysis of the membership roster of the local chapter of the National Machine Accountants Association.
3. A tentative interview guide for the collection of data pertinent to this study was prepared. The interview guide was used to maintain uniformity in the collection of data.
4. The tentative interview guide was utilized in a number of trial interviews for the purpose of determining the availability of the data and the adequacy of the instrument. From the information obtained in the trial interviews, case reports were written relative to each of the individual accounting units. Certain minor inadequacies in the interview guide were disclosed in this trial process.
5. Following the trial interviews, the interview guide was revised to include more comparative data, check points on the accuracy of the information desired, and a division of topics to provide for logical consistency in collecting the data and preparing case studies.

6. When it was determined that an adequate interview guide and procedure had been developed, personnel in 42 accounting units were interviewed.
7. A comprehensive case study of the machine-accounting procedures in each company was written immediately after each interview.
8. The information discovered in the literature and collected by means of the case studies was summarized, interpreted, and compared.
9. The final step in this study involved presentation of the data, summarization of findings, and the development of specific conclusions.

In Chapter II of this report, a review of literature relative to office automation is presented. Chapter III is an analysis of the circumstances and methodology under which the data were accumulated in this investigation. Chapter IV constitutes an analysis of the data obtained in the interviews with representatives of punched-card equipment manufacturers and management personnel of machine-accounting installations. In Chapter V, the case-study data are summarized and interpreted so that the implications of machine methods of accounting and automation are clearly revealed. The final chapter of this research report consists of a summary of findings and presentation of conclusions based on those findings.

CHAPTER II

BACKGROUND FOR THIS STUDY AS REVEALED IN CURRENT LITERATURE

A review of related research, such as is commonly presented in a doctoral dissertation, could not be developed as a part of this research report. The problem which was investigated is unique in that it concerns a relatively new phase in the total development of accounting practice and no significant prior research has been conducted relating directly to the problem.

After having exhausted all sources of reference, the author reached the conclusion that pertinent findings from prior research were not available with which to introduce consideration of the problem in this investigation. Therefore, an attempt is made in this chapter not to review past research but rather to present general background information which is pertinent to an analytical consideration of the effect of automation on the accounting phases of business enterprise and upon education for business. In an attempt to appropriately prepare the reader of this report for analysis of basic data, the author presents here: a discussion of the historical development of automated accounting

systems, a general description of the impact of automation as revealed in the writing of businessmen, and a general description of the significance of automation as it relates to educational preparation for employment in business occupations.

Historical Development of Automation in Accounting

Automation as defined in Chapter I is the continuous and integrated operation of data processing through the use of automatic machines. Based on this definition, the ultimate in an accounting machine would be a device into which original data of a business could be inserted, and out of which would come all necessary completed reports and documents. At the present time there are no machines that function to such a high degree of automation.

Automation as it relates to accounting can be traced back to 1880 when Dr. Herman Hollerith, a noted statistician, was engaged as a special agent to process and tabulate the 1880 census. Because of rapid increases in population and the time required to determine the census figures, it was apparent that when the work was completed the census figures would be of limited value. Dr. Hollerith believed that some mechanical aid was necessary to avoid the complete failure of the project. He developed a system of transcribing census data on paper strips by punching holes instead of writing numbers. These punched holes then actuated automatically,

statistical machinery by a magnetic principle. Tests proved that data could be transcribed in two thirds the time of other methods and could be tabulated eight times faster than by other tabulating methods. The first Hollerith machines were a pantograph punch and an electric accounting tabulator with a sorting box. This was the beginning of punched-cards¹ methods.

Upon leaving the Census Bureau in 1896, Dr. Hollerith organized the Tabulating Machine Company and in 1901 introduced the basic form of a numeric-punch keyboard for preparing cards for further processing. In 1911, the Tabulating Machine Company merged into the Computing-Tabulating-Recording Company which was the forerunner of the International Business Machines Corporation.² The International Business Machines Corporation, hereafter, will be referred to as "IBM"; which through common usage has become the identifying term for this company and its equipment.

As a result of Dr. Hollerith's success with the 1880 census, Mr. James Powers, an engineer, was employed to carry out the development of machines for the Census Bureau. Like Dr. Hollerith, upon completion of his governmental service, Mr. Powers organized a machines manufacturing business known as the Powers Accounting Machine Company. This company and

¹"History of Tabulating Machines," The Punched Card, I (Detroit: The Punched Card Publishing Company, 1952), p. 8.

²Ibid., p. 8.

the machines it manufactured constituted the basis for the development of the Remington Rand Division of the Sperry Rand Corporation.¹ This company and its equipment will be referred to as "Remington Rand" throughout the remainder of this study.

Following the first inventions of Hollerith and Powers, tremendous strides were made in the development of punched-card machine-accounting equipment. Contributing to the continued improvement in the processes and machines were such men as W. A. Lasker, Walter V. Davidson, Arthur Pentecost, and Thomas J. Watson.

For approximately 30 years punched-card equipment was used exclusively in statistical work to tabulate information through a counting process. In 1913 the first printing tabulator was produced by the Powers Accounting Machine Company. From 1913 until 1928, when IBM introduced its first general purpose accounting machine and the 80-column card, punched-card equipment was continually being improved upon and new pieces of equipment added. In 1931, Remington Rand introduced the 90-column card and equipment. At approximately the same time, the IBM all-purpose alphabetic accounting and document-writing machine was introduced. By 1936, IBM had standardized the name of its equipment to "electric accounting machines," considering this terminology as properly descriptive of its products.

¹Ibid., p. 9.

Vannais, a certified public accountant practicing as a consultant on mechanized accounting, wrote in the Journal of Accountancy in 1940:

So far as accounting is concerned, the punched cards first actuated a printing machine less than twenty years ago and the modern alphabetic equipment has reached the ripe old age of ten. The basic soundness of card-operated equipment has made its growth phenomenal--it is, in my opinion, here to stay.¹

Today, less than twenty years later, leaders in business and industry are wondering if card-operated equipment is not already obsolete. Robert E. Slater, Vice President and Controller of the John Hancock Insurance Company, states:

The question of whether or not punched cards are becoming obsolete has been asked by management many times during the past several years. It is being asked a great deal more since the advent of magnetic tape and electronic computer systems.²

The development of electronic computers was the next major contribution in the realm of automatic data processing. The first automatic computer was put in use in 1944. This computer was the Harvard Mark I Relay Computer.³ The Mark I was by today's standards a rather slow machine because of the electromechanical devices used in activating the machine processes.

¹Leon E. Vannais, "Punched Card Accounting from the Audit Viewpoint," reprinted from the Journal of Accountancy (American Institute Publishing Co., Inc., 1940), p. 36.

²Robert E. Slater, "Punched Cards--Are They Obsolete?" Office Management, XVII (January, 1956), p. 19.

³Ned Chapin, An Introduction to Automatic Computers (Princeton, New Jersey: D. Van Nostrand Company, 1957), p. 227.

In 1947, at the Moore School of Electrical Engineering at the University of Pennsylvania, the first high speed electronic computer was developed. This was a machine developed for the United States Army and was known as the "Electronic Numerical Integrator and Automatic Computer."¹

During the period from 1947 to 1953, computer development was concentrated around two factors. First, a great deal of attention was given to the logical design of computers; and second, there was intensive activity among technical groups in the construction of automatic computers. It was during this period also that large numbers of business firms became producers or users of computers. During the year 1954, growth of interest among businessmen in the machines was especially rapid as indicated by Canning's statement:

Although few were anxious to pioneer in the use of these machines, many nevertheless saw their potential benefits and decided to become informed on the subject. And there were enough pioneers--men who decided to take a chance and order some equipment--to consume the complete output from at least one leading manufacturer for several years.²

A combination of power, complexity, cost, and newness seemed to surround the computer with an air of mystery and occasionally tended to hinder its acceptance and application in business. The air of mystery was explained by Chapin:

¹Ibid., p. 230.

²Richard G. Canning, Electronic Data Processing for Business and Industry (New York: John Wiley and Sons, 1956), p. 2.

This air of mystery is caused by only one thing--a lack of understanding. The profitable application of any tool by business management implies the understanding of that tool. This is particularly true of the automatic computer, because it is one of the most powerful and most complex tools for data processing that can be used in business. In addition, it is most applicable in an area of business that up to recently used the least tools--the office. These factors tend to compound the lack of understanding of the automatic computer in business.¹

The general misunderstanding which currently exists relative to the use of automatic computers is due, at least in part, to two aspects of their historical development. First, automatic computers were originally conceived, designed, and constructed to meet the data processing needs of scientists and engineers. Second, the development of automatic computers took place under the momentum and guidance of scientists and engineers, not business people.

Because of the first factor, even though today this equipment has been redesigned to meet data processing needs of business, management people still conceive of automatic computers as devices requiring scientific and engineering skills in their operation. Because the development of automatic computers was guided by scientists and engineers a vocabulary has come into existence that is not readily applicable to business situations.²

Considered to be the first electronic calculator for commercial use was the IBM Card Programmed Calculator (CPC)

¹Chapin, op. cit., p. 1.

²Ibid., p. 2.

introduced in December, 1949. This machine was not fully automatic, but it was none the less capable of storing programs and virtually operating itself. The card-programmed calculator is actually a combination of several basic punched-card machines coupled together to form a self-contained computing device. This device is comprised of a storage unit and accounting, calculating, and card-punching machines. At one time, over a thousand CPC's were in use.

The next major contribution to computers for commercial use was the Remington-Rand UNIVAC I (UNIVersal Auto-Computer), available in April, 1951. Following the development of the CPC and UNIVAC, several smaller companies were formed for the development of other automatic computers.

It is interesting to note that the production of computers during the five-year period between the first high speed computer in 1947 and the UNIVAC I in 1951, was limited to 12 machines and of these only three were available for commercial use. In the next five-year period, 1952 to 1956, a total of 56 machines were produced and 28 were made available for commercial use.

Chapin,¹ in discussing the chronological development of automatic computers, indicates that by December, 1956, the estimated number of automatic computers in commercial use was 864. Of this number, 66 were classified as "low priced"

¹Ibid., p. 229-240.

(\$150,000 or less), 635 were classified as "medium priced" (\$150,000 to \$750,000), and 163 were classified as "high priced" (\$750,000 and up).

In 1956, the IBM 650 was the most extensively used computer with 566 units used commercially. These 566 units constituted 65.5 per cent of all the automatic computers used in business enterprises. Of the total number of computers in existence, 669 or 77.0 per cent, had been produced by IBM.

The relatively phenomenal growth of computers in the period from 1951 to the present is indicative of a new era in the processing of accounting data. In a very fundamental sense, the use of electronic data processing by business and industry has just begun. It is estimated, by authorities on automation, that in the coming years thousands of business concerns will be using automatic computers, the tools of electronic data processing. It is also evident that applications for electronic data processing will be improved upon, always striving for the ultimate of accounting data processing--a machine into which original accounting data could be inserted and out of which would come all necessary completed reports and documents.

"Electronic data processing" serves as the identifying term for the entire area of utilization of electronic computing and accounting devices. However, when used in relation to integrated data processing, the term pertains to

a special segment of the broad area of automation. Integrated data processing, by definition, presumes to make the processing of related data, by whatever method, a harmonious and efficient whole.

The idea of integrated data processing, as an automatic system of accounting, was introduced to 1,700 businessmen during a conference of the American Management Association in Atlantic City, New Jersey in February, 1954. Since that time, the idea has spread throughout business and industry with amazing speed.

Integrated data processing is not an entirely new creation. It is one of the modifications, so prevalent in automation, where several existing ideas are formed into a new and more effective system. Van Gorder indicates that it may be described fairly

as a plan for mechanizing the recording, transmitting, and re-use of necessary business information. Integrated Data Processing, in other words, is a plan for mechanizing business paperwork.¹

Integrated data processing has two prime purposes: (1) the rapid preparation of information as needed and in the form in which it is needed and (2) the elimination of human failures through reducing the amount of direct human manipulation in the process. At the present time, much is being done in the business machine industry to fulfill these

¹Harold F. Van Gorder, "Achieving Greater Productivity in Accounting Through Integrated Data Processing," National Association of Cost Accountant's Bulletin, XXXV (August, 1954), p. 1708.

two basic goals in the processing of business information. The term "integrated data processing" appears to be on the verge of becoming as popular a term as "automation" itself.

Kami, in discussing integrated data processing and the extent of its use in accounting procedures, indicates that, even though there have been great strides forward in the field of data processing, most businesses are still far from being truly integrated operations. Kami states specifically that:

No case history exists where the organization of a transaction such as a customer's order, creates an automatic chain reaction through sales, production scheduling, raw material and parts requisitions, purchasing, and other departments, affecting simultaneously or in the optimum time sequence all the parts of the company.¹

It is evident that if true integration is ever achieved in the processing of accounting information, such processing will reach the level of automation now present in the production phases of industry, where raw materials enter manufacturing processes and emerge as finished products with little or no human intervention.

It is interesting to note at this point that punched-card, electronic, and integrated data processing are specific systems of processing accounting data. The broader terminology used to describe all systems that tend to eliminate repetitive clerical tasks is "automatic data processing."

¹Michael J. Kami, "Why Business Research," Printed pamphlet of the American Management Association, Inc., 1956, p. 3.

The significance of automatic control in business and industry was emphasized to the general public in 1948 when Delmar S. Harder, an officer in the Ford Motor Company, coined the word "automation." While speaking of the automatic machine tools in a new production line, he said: "What we need is more automation."¹ It has been since 1948 that business applications of automation have become important in the thinking of businessmen and business educators. Because business needs today's accounting data for the planning of tomorrow's business, the use of automatic systems will undoubtedly become the rule rather than the exception. Businessmen and business educators must soon give serious consideration to the effect of automation on personnel.

Impact of Automation on Accounting

The impact of automation on accounting systems and procedures, and the problems resulting therefrom, is discussed in this section from an analytic point of view. The literature analyzed for ideas appropriate to this presentation was that provided in business periodicals directly concerned with problems of business associated with accounting and its implementation. The business periodicals and the publishers which provided information pertinent to this report were the following:

¹James R. Meehan, "Automation and Business Education," The Balance Sheet, XXXVII (January, 1956), p. 196.

<u>Periodical</u>	<u>Publisher</u>
American Business	Dartnell Publications, Inc.
Business Week	McGraw-Hill Publishing Co., Inc.
The Controller	Controllers Institute of America
Harvard Business Review	Graduate School of Business Administration, Harvard University
Journal of Accountancy	American Institute Publishing Company
Journal of Machine Accounting	National Machine Accountants Association
Machine Accounting and Data Processing	Gillie Associates, Inc.
National Association of Cost Accountants Bulletin	National Association of Cost Accountants
The Office	Office Publications Company
Office Appliances	Office Appliances Company
Office Economist	Art Metal Construction Company
Office Executive	National Office Management Association
Office Management	Geyer-McAllister Publications
Systems Magazine	Sperry-Rand Corporation

The search of the periodical literature resulted in an accumulation of ideas pertaining to the installation of machine accounting units. The literature also revealed information regarding the handling of isolated procedures such as payroll accounting, insurance premium billing, and inventory control. Much of the periodical literature dealt,

in general, with the effect of automation on accounting systems and procedures. In some cases, benefits of automation in accounting were enumerated; in others, problems involved and methods used to solve them were specified.

The periodical literature published to date definitely establishes the need for improved accounting systems. It is generally understood that an accounting system in any business organization can be justified only in terms of the extent to which it provides the information required by management in a highly competitive economic structure. Present-day business conditions necessitate more information, more complete and extensive records, and more frequent reports to management. Because of these extensions of the basic accounting function, businessmen have been forced to investigate possibilities in the use of machine-accounting techniques. In this era of high costs, all businesses, large and small, are seeking ways and means of providing management with business data in a fast and accurate manner and at a minimum cost. Evidence of the move in this direction is the constantly increasing application of modern electric accounting machine methods to an amazingly broad range of business activities. Substantiation of this statement is to be found in the article in Time as follows:

The income from sales and rental of IBM, the leading producer of punched-card and electronic accounting data processing machines, has increased by 400 per cent in the past ten years and it has been estimated that it's gross income will increase 25 per cent a year for the next five years.¹

¹"Business," Time, LXXI (June 3, 1957), p. 82.

Regardless of size, modern businesses need up-to-the-minute figure facts upon which to base their business operations, present and future. The smaller the business, the narrower the margin of allowable error on any single business decision. Immediate availability of business data is essential to management today. Indicative of the truth of the later statement is the comment of a manufacturing executive:

Our growth was far outrunning our ability to control the operation. We couldn't get the information we needed to analyze sales or plan production. Invoices and statements were far behind.

We were trying to overcome the difficulties inherent in any manual system. Our business was expanding quite rapidly and we were running out of room in which we might put additional people. At this point, we decided to investigate machine accounting.¹

The obsolescence of manual methods of accounting was emphasized by an official of a common carrier when he stated:

By July, 1952, it became apparent that manual bookkeeping methods could no longer keep pace with the accounting needs of our company. We had 18 employees in our accounting department, and were still not able to keep up with our record keeping as closely as we liked. At that time, we started our first installation of Remington Rand punched-card accounting machines.²

It is evident in 1959, that the use of punched-card accounting systems constitutes one medium for accomplishing economical accounting based on rapid and accurate data processing. This is substantiated by numerous reports of the

¹Richard S. Wolff, "IBM Management Interview," Time, LXXII (June 30, 1958), p. 2. (Advertisement verified by letter on file, dated November 21, 1958).

²Murray M. Dickson, "Electronic Motor Freight Accounting," Systems, XX (January-February, 1956), p. 15.

adoption of punched-card methods in almost all phases of business and industry.

Machine utilization is obviously not limited to any specific type of business or accounting application. The survey of literature made by the author revealed references to the use of automatic-accounting equipment in a great variety of types of businesses. The literature reveals that machine-accounting methods are equally appropriate for varied business operations such as: banking, insurance, hospital service, manufacturing, public utilities, railroads, and government agencies. The literature likewise reveals that machine-accounting methods are appropriate for use in a wide variety of accounting applications such as: trust accounting, subscriptions records, payroll preparation, sales analysis, operating expense reports, inventory control, labor distribution, production control, cost of sales analysis, government revenue billing, accounts receivable billing, and credit and collections work.

Analysis of the literature pertinent to the many phases and facets of automatic-data processing reveals that certain specific elements of the impact of automation are emphasized over and over again by the various authors. These generally fall into two natural groupings involving the personal and technical aspects of automation. These two major elements are pointed up in the sections of this research report which follow.

Impact on Personnel

Automation may affect business and industry in a variety of ways, many of which are not readily or immediately apparent. Certainly, this report relative to the effect of automation on accounting practices and procedures must be concerned with the impact of automation on personnel in terms of resistance to change, re-training and re-locating of personnel, and requirements for initial employment. The success or failure of any accounting system, regardless of the degree of automation, depends on the adjustments made by all personnel involved.

Personal resistance to change.--Tradition plays an important part in the operation of most business enterprises. The advent of automation throughout business and industry has tended to up-set tradition and frequently has resulted in cases of personal resistance to change. In most instances, such resistance has been successfully resolved, although in a few cases attempts to automate have been frustrated.

When any type of automatic data-processing system, whether it involves relatively simple punched-card equipment or extensive electronic computers, is inaugurated, there are likely to be persons in management, accounting, and even clerical positions who resist the change. One type of individual offering resistance to modernizing of accounting systems is the one bound by tradition and habit. Such an individual is prone to make statements such as: "We have

been doing all right for 50 years with the old system" and "Everybody already knows how the old system works." From a strict accounting point of view, these statements mean that the person involved believes manually-prepared records and reports are adequate to meet the needs of business today.

Another type of individual offering resistance to the modernizing of accounting systems is one who fears the complexity of the machines in automation. This person also fears that the machines will cause him to lose his job. The fear of loss of jobs is based on the fact that one of automation's prime objectives is that of decreasing cost through reduction in numbers of employees. The number of employees eliminated may range from a few to several hundred based on the extent of machine utilization and the number of accounting functions involved.

The discussion of the effect of automation on employment in Chapter I, reveals that automation has not to the present time resulted in reduction of the total labor force. It does, however, result in shifts in employment as jobs are eliminated. At the same time, higher-level jobs are generally created and employment is stabilized. In numerous cases, automation has resulted in a need for increased numbers of employees.

Regarding the employment factor as automated accounting systems are installed, Doyle states:

Previously, these reports were hand posted and required a staff of 25 people. With tabulating

machines we were able to turn out the reports with only five people and release the others for other important duties.¹

Statements of businessmen provided for Polishook, in a Business Education Research Associates pilot study on automation, indicated as follows:

Accounts Receivable required 15 employees prior to installation of our automated system; now only four employees are required.

Machinery has replaced workers; growth has more than taken care of them.

One department, before it was mechanized employed five people. It now has 12 employees.²

Since it appears that machine-accounting methods are advantageous, an effort must be made to prepare personnel for the required changes. Successful change to machine methods is always dependent upon proper acceptance by the people who will operate the machines as well as those who will use the data provided by the machines. Thus it is mandatory that something be done to prevent or overcome personal resistance when change to an automated system is to be accomplished. For example, an official in a large insurance company has stated that

a program was established to provide employees information and education. A meeting was held of all personnel from the ordinary insurance and related processing areas for the purpose of advising them that the study was being undertaken. It was explained that it

¹Charles H. Doyle, "Controls for Defense," Systems Magazine, XV (September, 1951), p. 27.

²William M. Polishook, "The Effect of Automation on Training," The Business School Executive, XIV (June, 1958), p. 46.

(automated accounting system) had the full support of management, that its objectives were such that the end result hoped for would be a savings in expense through a reduction in staff, and that the nature of the work done by the computer would be such that the highly repetitive tasks would be the ones that would disappear.

The approach to employee education stressed the viewpoint that freedom from these highly repetitive monotonous operations would be a boon to mankind, and specifically to the employees of Pacific Mutual Life Insurance Company. Coupled with this was the assurance that no employee doing his job competently would find himself a sacrifice on the altar of machine efficiency.¹

John D. Hale, machine accountant for The Toledo Blade, makes the following comment in regard to cooperation of all parties concerned during the transition period:

I believe it has to be the will and desire of all parties involved to make it (punched-card method) a success, or like any other tools, if operated incorrectly--the result is failure.

There isn't any mystery to punched-card operation, even though some of the results appear magical in comparison. I feel if properly explained and accepted, little encouragement is needed to throw the switch and the personnel down a new track of thinking.²

From these statements, the reasons for resistance on the part of employees are obvious because they reiterate the fears expressed by the employees in business concerns studying or using automated systems of accounting.

Whenever possible, business managers have found it desirable to follow a policy whereby no one is discharged

¹R. D. Dotts, "UNIVAC Passes Time Study Test," Systems Magazine, XIX (September-October, 1955), p. 13.

²John D. Hale, "Punched-Card Accounting in Newspapers," Journal of Machine Accounting, VII (March, 1956), p. 4.

when changes to automation are effected. It has been emphasized in the articles written by businessmen that the normal personnel turnover among all employees usually will provide vacancies which can be filled by individuals who are displaced in the accounting unit by automation.

The following statement regarding personnel involved in a change to an automated system illustrates how the element of normal attrition functions:

The men on the programming staff were up-graded. Of the others affected, most were transferred to other work at similar or better wages. Dismissals were not a problem. The clerical work involved had had a high turnover rate. From April, 1956, forward no new personnel were hired fulltime, with the result that by fall regular departures had prepared the way for a changeover without difficulty.¹

Even though many people still look with fear upon the machines the "electronic age" is producing, the current, increasingly accepted point of view regarding automation is changing. The idea that the machine will take the place of people is giving way to the fact that use of automatic machines merely eliminates routine and the possibility of human error in providing management with more information quicker. Also, it is becoming apparent that more people will be required to interpret and use the information provided through automation, causing an up-grading of personnel in business concerns that utilize automated equipment in their accounting systems.

¹Paul Kircher, "Study of a Successful Computer System," The Journal of Accountancy, C (October, 1957), p. 63.

Re-training and re-locating.--After a decision has been made to acquire machines for an automatic data-processing unit, a training program for personnel must be instigated. Diebold, in a speech before the Second Annual Automation Conference of the University of Chicago, discussed the problems stemming from the personnel element and indicated the importance of re-training when he stated: "The principal problem of automation in the office is a human problem; it is a problem of education and training."¹

The extent of the training problem is usually considered to be proportionate to the size of the data-processing unit and the degree of automation attained in the data processing. Personnel who will actually work with the automatic data-processing system and others who will be affected by its presence need to have technical knowledge about how their jobs are going to be changed and what their new duties will be.

To accomplish the installation of an automated accounting system, three kinds of training must be provided for the personnel immediately affected by the situation created by automation: (1) orientation training, (2) technical training, and (3) re-location training. These three kinds of training are provided to educate all employees about

¹Frederick Vogel, "University of Chicago Holds Second Annual Automation Conference," Office Management, XVIII (January, 1957), p. 30.

automation in general, to educate accounting personnel in the technical application of the automatic system, and to educate those employees who will be transferred to another unit in the organization for new jobs.

Orientation training is designed to "sell" the automatic system to all company personnel. The content of the orientation training should include a general build-up about the company needs, the data-processing problem that the company faces, the basis for the decision to install an automatic system, and the benefits to be derived from its use. Since the basic objective of orientation training is to inform employees about automation and its advantages, the more widely and thoroughly the automatic system is explained the better.

The technical training which must be provided pertains to the use, operation, and maintenance of the machines of the automatic system to be utilized; and specific job training for personnel not to be re-located, but who must perform somewhat different duties because of the change in systems. This training should relate to the fundamentals of the automatic system, along with careful preparation in operation of the machines and procedures of the system. The purpose of this training is to assure a technical knowledge of, and a willingness to carry on, the work involved in the new system. It is generally recommended that the actual machine training be provided by the manufacturer of the equipment,

or some equivalent training such as special courses offered by certain universities or business colleges. On-the-job training usually is satisfactory for specific job training if the views of the supervisor are compatible with the use of the automatic system. The on-the-job training program should follow the organizational structure of the business concern so that individuals at each level of supervision hold positions of appropriate authority.

Re-location training must be provided for those persons who are placed in new positions in another department in the organization. In such cases, the workers affected must understand that both the employee and the employer will benefit from the change. Through increased efficiency, the employer can earn more profit, pay higher wages, and provide better services. Because of the instruction, it is possible for the employees to raise the level of their personal skill. The transfers to other departments should be of such a nature that those involved will tend to regard themselves as having been promoted rather than merely transferred or displaced.

The accomplishment of the needed training for automation varies from company to company. However, methods and techniques used to implement internal educational programs are often similar. Frequently, such training is given by means of seminars, evening classes, and tours of data-processing centers. In most cases, bulletin-board displays

are utilized, along with projection of slides, showing of movies, and extensive use of prepared literature. Usually, the instruction is designed to show that the automated accounting system is just another device which will contribute to making the company operation more efficient, productive, and competitive; and consequently, increase job stability for its employees. The following statement illustrates the basic ideas in training for automation as it exists in one business firm:

A prime emphasis has been placed on educating and training our own people to make effective use of the equipment, as each use is carefully studied, analyzed, and tested. The equipment is very costly and much pioneering work is required to make full utilization of such powerful equipment. It is the confident opinion of those assigned to this area of Gulf interest, that a group of highly trained Gulf people will remain the key to our success. The difficulty of training people and gaining experience in applying electronic computers efficiently cannot ever be overestimated. The future of this equipment in our company looks very bright, and we have every intention of adopting computers in all areas where their use proved feasible and economic.

It is also important to restate that the purpose of a computer program is not the replacing of people with machines. The machines, instead, extend the power and scope of present work forces in handling the steadily growing business that we all wish to maintain for our company. With computers, it is not only possible to process vital--though routine--scientific, accounting, and operational matters quickly, thoroughly, and efficiently, but it is also possible to "tackle" certain other problems that could not be handled previously because of limitations of time or available techniques. In effect, a powerful, new tool has been placed at the disposal of Gulf personnel, and it remains our day-to-day job to put it to wise and judicious use.¹

¹"Gulf Tools Up With Electronic Computers," The Orange Disk, XIII (January-February, 1958), p.24.

The foregoing statement appeared in an article describing the use of electronic computers for processing data as part of the Gulf Oil Corporation's program of educating its personnel for automation. The article described the typical kind of company-wide training of personnel for utilization of automated-accounting and other data-processing systems.

At the time this study was completed, the responsibility for providing adequate technical operational instruction rested in a large measure with the equipment manufacturers. In Oklahoma City both IBM and Remington-Rand provide for instruction on punched-card and other automated equipment.

The local district office of IBM has a regularly-scheduled customer training program made up of classes covering the operations of machines for data processing and the management aspect of the installation of data-processing units. The local office of Remington-Rand only schedules training on demand and adapts course presentation to the needs of the individuals requesting instruction. Both companies also provide special instruction conducted by their representatives at the time of installation of units and when changes of equipment take place. This instruction, when offered, is generally in the form of on-the-job training.

Insofar as operator training is concerned, the most important factor is actual experience on the types of equipment to be utilized in the data-processing units. Through formal classes, instruction can be offered concerning the purposes and functions of all the "buttons and switches"; but experience at specific machines is required for mastery of the actual manipulation of the equipment.

The following statement illustrates the use made of the training programs provided by the automatic data-processing machine distributors.

Tabulating departments are composed of trained personnel.

The girls attend a two-week course. The course, conducted by one of the foremost suppliers of business machines, is for the purpose of teaching key-punching and other allied skills.

The men who operate larger machines are given four weeks of specialized training--either locally or at the supplier's school in Endicott, N. Y.¹

It has been established that the field of machine accounting is still in its infancy. Because of the rapid strides that have been taking place, many of the individuals who are engaged in machine accounting are specialists only in the machine-utilization phases and have very little background in accounting itself. This indicates need for more education in the theory of accounting as it is applied in machine usage. The following excerpts from an article by Kerman, a machine-accounting supervisor, emphasize the need

¹"Electronic Brains Speed Paper Work," Reprint from Armour Magazine (February, 1954), p. 3.

for continuous education of individuals in this field of specialization.

Tabulating personnel must try to obtain some kind of formal accounting education.

It must be remembered that ambition is the keynote to success, and to be successful in this field (machine accounting) one must put a little bit of his spare time into study and advancement. . . . Too many tabulating personnel are lacking in any formal accounting education, resulting in the hampering of their success in the field; and it must not be forgotten that this situation also exists among accountants. . . . Tabulating personnel are also becoming specialists in their field because of the schooling and experience needed to perform their duties properly. They must have a complete knowledge of their equipment, know how to maintain procedures, have an accounting education, and know how to make minor repairs on equipment to save lost time when a breakdown of some sort occurs.

As mentioned before, too few of these tabulating personnel have an accounting education. Today it has become a must in order to have complete cooperation with accountants, and attain the success possible through their combined efforts. The training of all personnel through company classes and outside sources should be a prominent feature of any punched-card program.¹

Kerman also indicates another training need when he implies that an accountant should obtain all the knowledge of punched-card machines possible just as the machine operator should have formal accounting education. Wright indicates the interest of the accountant in acquiring a knowledge by the following statement:

Evidence of the new era (machine processing of accounting data) is found in a flood of published articles, in the increasing popularity of conventions, seminars, and meetings, and the heavy enrollments in courses

¹A. J. Kerman, "More Punched-card Training Needed," Systems Magazine, XIX (November-December, 1955), p. 10.

conducted by equipment manufacturers. It is evident in sparkling conversation between accountants.¹

These comments concerning training, re-training, and re-locating of people in the accounting phases of business and industry emphasize the ideas that automation creates bigger jobs, calls for higher caliber people, and brings about a need for different skills. The following section is concerned with the requirements for initial employment in this new "era" of accounting-data processing.

Requirements for initial employment.--It is interesting to note that in the publications surveyed very little appears which specifically indicates changes in requirements for initial employment in the field of machine accounting. However, in a great number of instances there are indications of the types of individuals sought to fill the jobs created by automated-accounting data-processing units. In this section, specific personal traits and requirements of education and experience are discussed in terms of information obtained from study of periodical literature.

Kircher, describing the experience of the Farmers' Insurance Group in installing an automated-accounting system, makes the following statement in regard to choice of personnel:

The man in charge of the programmers was chosen from the punch-card group in a regional office, where

¹Robert G. Wright, "Electronics Challenge to Machine Accountants," Journal of Machine Accounting, VII (April, 1956), p. 4.

he had displayed ability to anticipate operating needs and to think beyond the confines of his immediate job. The others were also top men from tabulating, with long experience in the company. In fact, the only selection process was competence on the job, as demonstrated in previous studies and system changes. None of the men had special mathematical training.¹

This clearly illustrates the requirements of one company, but is contradictory to the following statement:

If maximum advantage is to be taken of the capabilities of the electronic computer, the techniques of mathematics and science must be applied to the solution of management problems. This requires a peculiar breed of person--one who is a competent scientist, yet has a knowledge of the interest in business problems.²

These two statements illustrate two extremes in personnel selection. In the early days of automatic-data processing, the tendency was to hire technicians, electronic engineers, and even mathematicians to take control of automated-accounting units. These individuals thoroughly understood the mechanics of the automated equipment but rarely the operational procedures of the business concerns. Today it is generally accepted that it is easier to teach the machine to someone who understands the business. "Dependence on a man who 'knows a machine' to figure out the best applications for a company is a quick road to trouble."³ To further illustrate the idea that the individual who is to

¹Kircher, loc. cit., p. 61.

²E. W. Martin, "Electronic Data Processing in the College Curriculum," American Business Education, XV (October, 1958), p. 21.

³"Special Report: Computers," Business Week, No. 1503 (June 21, 1958), p. 87.

supervise an automatic-accounting system should first be a company man, Dreyfack states:

The experienced supervisor or department head has one major advantage. His knowledge of the business and the operation of the office will be of more value than the technician's knowledge of the machines used to automate the system.¹

The literature indicates that an individual working in the field of automatic-data processing should possess certain traits, abilities, and willingnesses. The personal traits deemed desirable are intelligence, enthusiasm, energy, and optimism. Each individual should also possess an ability to analyze, think logically, reason abstractly, perform routine work accurately, and understand spatial relationships. In addition, individuals should be willing to devote much time and effort to developing the automatic process and to learning the new tasks involved.

The above-mentioned traits, abilities, and willingnesses are too general to offer much hope for developing a simple key for selection of individuals for the jobs in an automated system. It appears logical to assume that any intelligent individual with some imagination, initiative, computational interest and aptitude, and a specific interest in the machines and their work could be successfully prepared to operate the equipment of automation.

¹Raymond Dreyfack, "The Role of Automation in Freeing Managers for More Creative Work," Office Management, XIX (September, 1958), p. 80.

In any discussion of requirements for employment in a specific area of endeavor, the amount of formal education and the amount of work experience must be taken into consideration. In the periodical literature analyzed, very little material was found indicating specific changes in education or experience requirements for employment in automated units from requirements for employment in manual units. However, in the literature, the ability to analyze logically was pointed up again and again as being required of personnel working at all levels of automatic-accounting systems. The ability to analyze logically enables the individual to analyze each accounting function into steps and to put these steps in logical sequence so that the automatic system employed can manipulate them. It is interesting to note from the following statement that no specific course or level of educational attainment seems to give an individual the ability to analyze logically.

No particular educational background seems to produce the ability (to analyze logically) to any greater extent than any other. Some attempts at testing for this ability are being made, but no conclusive results have as yet been published.

A high school education appears to be sufficient for development of a competent operator.¹

To further illustrate factors of education, business executives and experts in the field of automation, testifying at the congressional hearings on automation and

¹A Study for Management: The UNIVAC II Data Automation System, Sperry-Rand Corporation, 1957, p. 19-20.

technological change, indicated that it was not necessary to have an extended education in the specialized areas of mathematics, science, engineering, or related fields to succeed in automation. In one instance, it was emphasized that there is no need for an individual to hold a college degree to be able to operate an automatic machine.¹

Reed, in his doctoral study concerning employment of beginning office workers stated:

The responses made by the office managers reveal that, in general, persons seeking employment in the 18 occupational classifications utilized in this investigation should be high school graduates.²

Key-punch and punched-card machine operators are included among the 18 occupational classifications involved in the foregoing statement, indicating that at least a high school education is the minimum requirement for these jobs. However, no specific program was recommended by Reed for preparation of an individual for the jobs of an automated system. An article reviewing jobs and job possibilities in general, indicated the qualifications for beginning office operators to be as follows: graduation from high school, ability to typewrite, good finger dexterity, skill with numbers, along with training in the use of machines. Because

¹U. S. Congress, Subcommittee of the Joint Committee on Economic Stabilization, Hearings, Automation and Technological Change, 84th Cong., 1st Sess., 1955, p. 385.

²J. Ralph Reed, "Circumstances Surrounding the Employment of Beginning Office Workers in Oklahoma City," Unpublished Ed. D. dissertation, University of Oklahoma, Mimeographed abstract, p. 3.

many large companies give on-the-job training, these basic requirements are considered adequate.¹

In summary, the basic requisites for employment in the jobs of automation have changed very little, if any, from those required before automation. The same personal traits desirable in any competent employee are sought, the basic educational attainment of high school is required, and individuals with as much work experience as possible are in demand. This perhaps implies that maturity is the most significant factor.

Impact on Efficiency

The impact of automation on the efficiency of the accounting unit resulting from a change-over from manual methods to machine methods is another basic factor considered in this study. Many articles depicting the preparation for and installation of automatic accounting-data processing units reveal that varying amounts of time are required to prepare accounting offices for machine utilization. The amounts of time vary, according to the type of equipment to be installed, from several months for the basic punched-card equipment to as much as two years for the high-speed computers.

It is apparent that accounting operations performed on machines must be developed in a deliberate manner. In

¹"Office Jobs; Pay and Prospects," Changing Times, X (June, 1956), p. 41.

many cases only one application is put into effect at a time; when that application is developed to the point of "near perfection," another application may be started. The following analytical statement by an official of a manufacturing concern describes what seems to be the general rule in the application of tabulating equipment to accounting functions.

It has been a step-by-step program, and though we have converted many computation operations to the machine already we are by no means through. We plan a much more extensive use of this equipment, and feel that the proper way involves what we have been doing; planning a step, instituting it, proving it in practice, then going on to the next improvement. Once a new procedure becomes established, it seems to melt right into the work flow and still permits time for the development and perfection of the next application.¹

Along this same line of thought, a utilities company official states: "Rather than over-extend ourselves by plunging into a complete change in program, we have embarked on a step-by-step approach that will keep us on firm ground all the way."² The impact of automation on the efficiency of the accounting unit, once the automatic system has been installed, is elaborated upon in the following sections of this chapter.

More information available.--Manually-prepared reports are rarely adequate to meet the standards and

¹R. Dean Turner, "It's 'Tab' All the Way," Systems Magazine, XV (March, 1951), p. 15.

²William F. Rowe, "Electronic Billing for Utilities," Systems Magazine, XIX (January, 1955), p. 20.

requirements of today's business. They are almost always limited in scope, simply because the extent to which manual calculations and tabulations can be accomplished is restricted. Once basic information, regardless of its business or accounting nature, is punched into a card, its use is restricted only by the limits of imagination demonstrated by the machine supervisor and management personnel. Edscorn, an executive of International Shoe Company, in a paper presented before the St. Louis Chapter of the National Machine Accounting Association, stated that: "Machine accounting makes possible studies so far beyond anything possible by manual methods that any compromise is a backward step."¹ The foregoing statement implies that extensive change occurs when machine-utilization techniques are adopted. In addition to a continuation of the long-standing recording function, accounting takes on a new, infinitely more extensive and significant function in reporting frequently to management.

In article after article businessmen, lauding automatic systems of various types, have made statements indicating that more accounting data is made available to aid in management decision making. Many of these statements are similar in tone. For example:

¹Ben E. Edscorn, "Accounting Machines in Market Research," Journal of Machine Accounting, VII (May, 1956), p. 20.

We now are able to produce 52 important management reports from the information and facts compiled in our basic punched-card payroll procedure.¹

Executives in several companies expressed the opinion that the greatest advantage of electronic data processing is its potential for providing new information for management.²

Information never before developed, because of size and complexity of task, is now available to management.³

Under manual methods, much valuable information is lost because of the cost involved in its preparation, or the time element involved, or the number of people that would be needed for the job. Gustafson quotes John Diebold to point out specifically what automation can do in improving management decision making:

Probably the most important use of the machines (of automation) will be in providing better management information more rapidly. It won't be a matter of producing the same kind of reports by computing machinery but producing better and fewer reports with newer and faster machinery.

One big publishing concern has a system of 330 reports. We cut it down to 30--all providing better analysis and interpretation than the company ever had before.⁴

¹Doyle, loc. cit., p. 19.

²Peter B. Lauback and Lawrence E. Thompson, "Electronic Computers: A Progress Report," Harvard Business Review, XXXIII (March-April, 1955), p. 125.

³Philip Gustafson, "What Computers Can Do For You," Nation's Business, XLIV (October, 1956), p. 42.

⁴Ibid., p. 111.

This possibility of providing management with improved information for decision making is now open to all business concerns whose operations warrant some degree of automation.

From the foregoing discussion, it might appear that the only logical step for a business is to install immediately some type of automatic-accounting data-processing system and thus solve all management difficulties quickly. However, it is obvious that machine utilization cannot solve all management problems and render decision making easy; it cannot be of help to everyone. In some cases, companies dazzled by the feats of automation may move too rapidly in acquiring the equipment of automation; and in their eagerness to enjoy the publicized benefits they may assign the equipment to the wrong people. However, in many cases automation does provide additional information, obtained quickly, enabling management to reach more readily appropriate operational decisions.

Speed and accuracy.--Speed and accuracy are two basic characteristics desired in any accounting system. The desire of management to increase the degree of speed and accuracy in accounting procedures is, in part, the reason for such tremendous interest in office automation. Automatic data-processing equipment and procedures provide degrees of speed and accuracy far greater than is possible in any manual-accounting system.

"Speed," in automatic data processing, involves the rapidity with which a specific machine can carry out a specific function assigned to it. It is the belief of the author that a comparison of accepted standards of performance with manual methods and the speeds that the various automatic machines can attain performing the same or similar functions clearly presents the potential of the characteristic of speed. In analyzing the comparisons between machine and manual methods, one must remember that standards are normally set up under ideal working conditions, usually with highly skilled individuals, performing each task separately not as a part of a whole operation.

Based on standards of performance, analysis between amounts of time and effort required to perform the higher-level accounting functions cannot be compared accurately. This is true because in manual methods a standard of performance is based on the performance of an entire processing operation from the source document, to completed form or statement; whereas, in machine methods, the data must be punched into tabulating cards converting the data to the language of the machine before performing the operation. There are, however, many routine operations, although not accounting in nature, occurring in an accounting office. Therefore, only the more routine or clerical tasks that do remain the same regardless of the method of data processing utilized are compared in this study. These comparisons are

presented to illustrate common clerical operations required in processing accounting data in terms that would be familiar to the reader.

<u>Operation</u>	<u>Manual Rate</u> ¹	<u>Punched-card Machine Rate</u> ²
Alphabetizing cards	150 per hour	2,000 per hour
Sorting and arranging cards	268 per hour	60,000 per hour
Addressing envelopes	300 per hour	9,000 per hour
Addition (30 3- to 5-digit numbers)	50-80 per hour	200 per hour
Multiplication (3- to 5-digit unit by 3-5-digit unit)	300 per hour	6,000 per hour

To illustrate further, a theoretical comparison, utilizing accepted standards of operation, was made between a manual system and a punched-card system for processing a payroll for 1,000 employees. The results were as follows: a net savings of 156 days, 8,736 man hours, and 10,000 dollars per year.³

What seem to be phenomenal statements are found repeatedly in the periodical literature where comparisons are

¹Marian Josephine Collins, "Handbook for Office Practice Teachers," Monograph 91 (Cincinnati, Ohio: South-Western Publishing Company, 1954), p. 11-15.

²IBM Operators Guide, International Business Machines Corporation, New York, 1955.

³Donald Race, "Automation for Payroll Systems," Drexel Ledger, IV (Summer, 1958), p. 28.

made between manual systems and automatic systems, or lower degrees of automation with higher degrees of automation. Savings in both time and money are constantly being reported by individuals representing almost all phases of business and industry.

The speed of equipment as it effects operational efficiency is depicted in the articles in periodical literature in many different ways. The following comments typically describe the savings credited to the speed of the automatic equipment utilized in accounting procedures.

It is now possible to get invoices into the mails within 24 hours after an order has been processed, as opposed to four or five days under our old system.¹

The entire operation for each day's average of 7,000 way-bills can be accomplished by the 705 in one hour and forty minutes, as against a previous total time of 60 hours required by punched-card equipment.²

One of the greatest problems of the stationer today is the lack of good inventory control tying up many "non-working" dollars that could be making new profits.

This IBM installation gives us instant, fingertip control where yesterday we worked on month-old information and hunches.³

By a simple changeover to punched-card procedures and paying by check instead of cash, our payroll department gave back to our management 9,000 productive man-hours. Under our prior system the entire shipyard,

¹H. C. Moog, "Electronic Billing and Stock Control," Systems Magazine, XX (November-December, 1956), p. 24.

²"Automation in the Office," Office Management, XVII (June, 1956), p. 43.

³Harold B. Speicher, "Automation Comes to the Office Supply Dealer," Office Appliances, CVI (October, 1957), p. 20.

approximately 35,000 employees, stopped work fifteen minutes before quitting time, on paydays. Now we pay the men right on the job.¹

Under manual methods it was impossible to have accounting information into report form before the twentieth day of the following month. . . . After this company's punched-card installation was put into operation a complete operating statement with all its ramifications, and many additional advantages, was available on the sixth day after the end of the month.²

Along with speed, the accuracy factor is usually considered as another phase of operational efficiency. It is apparent that in automatic systems a high degree of accuracy is a necessity because of the extreme speed in processing accounting information. This is true because even an insignificant error may be magnified extensively through immediate re-use of the incorrect data. Without a high degree of accuracy, the system would be of little or no value. The high degree of accuracy demanded of automatic machines is not essential in manual processing of data because verification is simpler.

It is estimated that three hours of computational operation using a large scale electronic data-processing system would be the equivalent of from eight to ten years of manual operations using a desk calculator performing the same computational tasks. Such operation without error is

¹Charles H. Doyle, "Controls for Defense," Systems Magazine, XV (September, 1951), p. 6.

²Harry I. Condon, "A Punched-card Installation Produces Statements in Six Instead of 20 Days," The Journal of Accountancy, LXXXVIII (August, 1950), p. 136.

routine for the automatic unit, whereas it is impossible for a human, operating a desk calculator, to work without error for eight to ten years.¹

It is undoubtedly true that the equipment of automation utilized in processing accounting information is structurally more reliable than mechanical equipment relying on a human being for its operation. Also, through reduction of the manual transcription of data, it is possible to reduce substantially the errors that often occur when data are transcribed several times manually.

Through verifying and the self-checking ability designed into the equipment, accuracy is almost guaranteed in punched-card and higher-level automatic data-processing equipment. For example, at the punched-card level of automation, accuracy control is a part of the accounting procedure as well as a feature of the machines. The procedure control is through a process of verifying the information punched into the cards through re-keying or re-punching the information from the source document. The machine feature is a comparing device, built into the machine and controlled through a wired panel, to verify the accuracy of the machine operation.

Articles relating the results of increased accuracy, for the most part, merely indicate that machine utilization

¹William B. Elmore, "Some Aspects of Reliability in Electronic Data Processors," Electronic Data Processing in Industry, ed. M. J. Doohar, American Management Association, 1955, p. 143.

has definitely increased the accuracy of the accounting procedures. The following comments are typical of the statements found in published literature illustrating the accuracy factor of automation.

The real benefits of the improved accounting methods are actually more subtle than apparent. Speed, increased accuracy, and amenability to double-checking are the most obvious advantages.¹

The value of these reports has been proved, not only in the savings in man hours at the year end and during the tax season, but also in later audits of our returns by state tax examiners. During these audits we have experienced no difficulty in substantiating our sales allocations because of the inherent accuracy of reports prepared from the same cards used in invoice preparation.²

In automating the order writing process one of the distinct benefits was improved accuracy. Correct price information, catalog numbers, product descriptions, shipping and invoicing instructions, etc., are mechanically written, minimizing chances for human error in transcription.³

The 705 has programmed into it certain validity checks. It will kick out many "impossible" coding combinations on transactions which are then returned for correction. The operational departments have established many review points to verify the accuracy of codes. Our audit programs include a sampling procedure to verify the accuracy of policy transactions.⁴

¹Ralph E. Byrnes, "Converting Accounts Receivable to a Tabulating Setup," Office Executive, XXXII (June, 1957), p. 20.

²Robert Charek, "Sales Allocation for State Tax Reporting," Journal of Machine Accounting, VII (April, 1956), p. 11.

³Walter T. Gibson, "An IDP Order-Invoice System," The Office, XLII (September, 1955), p. 79.

⁴John B. DeNault, "The Impact of Computers on Multiple-Line Operations," The Controller, XXVI (March, 1958), p. 143.

With the vast amount of work now being handled, we are impressed with the accuracy and reliability of the equipment.¹

Proof of the efficiency of the procedure is that our "discrepancies" (overs and unders) are now generally held to 1/2 % to 3/4 % partly because the possibility of human error has almost been completely eliminated.²

Through comparisons with manual processing of accounting, the factors of speed and accuracy become the basis for many of the "dollars and cents" savings discussed in the following section.

Cost.--It is a generally accepted fact that the main reason why most companies utilize automatic systems, in the processing of accounting information, is the long-run cost savings resulting from their use. Such savings may be in terms of dollar amounts or may be represented by reduced percentages of cost allocable to the accounting unit. In the latter case, more dollars may be spent for the automated process than for the manual process by increased operations resulting in a reduced cost percentage. The decision to install an automated system should not be based solely on direct dollar savings. Many of the improvements of the automated system over the manual system are found in elements that are hard to evaluate in "dollars and cents" savings. These may include such things as more information available

¹Turner, loc. cit., p. 15.

²Roy D. Maas, "Stock Control Through Punched Cards," The Punched-Card Machine Accounting and Data Processing Semi-Annual, VII, 1958, p. 96.

for management decision making, faster information to improve customer relations, and more accurate information through the elimination of time-consuming and costly errors. These three improvements were discussed extensively in preceding sections of this chapter.

Cost savings of automated systems may be classified in two separate and distinct groupings--direct savings and indirect savings. Direct savings may be defined as the decrease in cost resulting from the change of systems. The savings result from reduction in personnel needs, consolidation of operations, reduction of overtime operations, reduction of floor space required in automated systems compared to manual work space requirements, and reduction of supervision because fewer individuals are required to carry out the accounting function through use of automated accounting systems. Indirect savings may be defined as the decrease in cost resulting from the use of an automated accounting system in performing tasks impossible with a manual system. The results are found in the ability of the machines to provide more information more frequently, increased accuracy, and adaptibility to rapid growth in the accounting volume.

In periodical literature, descriptive articles on automation are generally written by individuals employed by business concerns. These authors have had first-hand experience in the use of automated equipment in the accounting functions. The following excerpts relating to the factor of cost savings are typical of the comments of such authors.

For years, we had peak problems and work overloads. It is only within the past few years that our accounting problems have settled down into a smooth work flow with very little overtime. This has been accomplished by close and careful study of the factors involved, the development of new procedures, and the selection of equipment better suited to the jobs (punched-card equipment).¹

Our estimate is that it would cost \$300,000 annually in additional costs if we tried to use manual methods. This is over and above the fact that it would be practically impossible to accomplish the work load on a manual basis.²

We began to realize net savings from the start. we have been able to transfer 9 employees to other duties and have completely eliminated the costly overtime work. We are now able to absorb the heavy summer business into the normal workload, and have also been able to expand bill extension work without adding any new equipment or personnel. In other words, the plan is paying off--not next year, but right now.³

As to personnel, the necessity of many hundred clerical overtime hours monthly has been eliminated; five employees have been released for other duties, and 50 per cent of six other employees' time has been reduced.

Most important is the intangible savings in material inventory surpluses and obsolescence that tend to creep in unless prompt action is taken at the right time.⁴

¹Robert B. Phillips, "When Dollars Go Greyhound," Systems Magazine, XV (March, 1951), p. 10.

²Richard W. Reuter, "Self-help on a Business Like Basis," Systems Magazine, XXI (November-December, 1957), p. 13.

³William F. Rowe, "Electronic Billing for Utilities," Systems Magazine, XIX (January-February, 1955), p. 20.

⁴Jack W. Schrey, "650 Evaluation for Production Control," Machine Accounting and Data Processing, I (November-December, 1958), p. 32.

The clerical work of six people is now being handled by the operator of an IBM data-processing unit; sales volume is increasing, yet inventory is being trimmed; working capital is being made available for expansion and modernization; buying economies are being effected, and up-to-the-minute reports are available concerning all aspects of the business.¹

It should be noted that when articles on automation are written by individuals not employed by business concerns using the equipment of automation a different point of view is frequently presented. The following quotation indicates a situation in which it was found through cost analysis that the extensive savings at first visualized actually could not be accomplished.

This month, the board of directors of a New York company will decide whether to install a medium-sized computer. A feasibility study concluded that the machine would rack up net savings of \$275,000 a year . . . \$600,000 gross savings, less incremental costs of \$325,000 for the computer operation.

Before deciding the board has had the figures rechecked by an outside organization which found that, of the \$600,000 gross annual saving; \$141,000 could be saved by re-organization and simplification in existing manual methods, \$169,000 could be saved by the improvement and streamlining of the existing punched-card system. The gross saving attributable solely to the computer would be \$290,000.

But the operating costs of the computer, plus start-up costs amortized on a five-year basis (not including the \$200,000 cost of the feasibility study) would come to \$325,000.

That would mean an actual net deficit of \$35,000 annually.²

Cost analysis, such as indicated above, may not cause companies to discard the idea of using automatic accounting data

¹Speicher, loc. cit., p. 20.

²"Special Report: Computers," loc. cit., p. 78-80.

processing equipment. In certain cases an annual deficit of \$35,000 would be considered a small price to pay for learning what an automated system might eventually do for the accounting operation.

Comparisons of cost savings, either direct or indirect, and machine utilization between existing automated accounting systems and manual systems contemplating the use of an automated system is sometimes dangerous and such comparisons are usually worthless because the extent of utilization is specific to each machine accounting installation.

Automation brings about another cost saving that is usually not emphasized in periodical literature relating to automatic-accounting procedures. This cost saving results from the improvements made in manual systems when they are facilitated through the studies made at the time installation of automated equipment is contemplated. It is safe to assume that many companies have studied the possibilities of the utilization of automatic-accounting systems but found that through improvement of their existing manual systems definite savings could be achieved. Decisions to delay installation of automated equipment undoubtedly have been reached in some such situations. Savings resulting from such "forced" improvements in manual methods can be indirectly traced or contributed to automation. However, if the automatic systems are installed, it is a generally accepted fact that even greater savings would result. The following

quotation serves to illustrate the factors of reduced costs in improvement of manual methods and further savings through automation.

Our studies showed that, in the six departments whose work was affected, about 55% of the total man-hours could be eliminated by the data-processing system. Costs of these clerical hours were calculated after making due allowance for the benefits of improvements in present methods which this detailed study pointed up as possible without the adoption of electronics. In other words, in making cost comparisons between present methods and electronic methods don't forget that one must also analyze costs of present methods made more efficient by improvements other than electronic.¹

A common error in evaluating the possible impact of automation on business is to make the assumption that the only effect it will have is the directly competitive one in terms of the equipment or process that it is to replace. Automation's most important impact on business results from its ability to facilitate more effective management decision making.

Relationship of Automation to Business Education

Automation, with what seems to be unlimited potential in the area of accounting and other office work, definitely affects business education and the business educator. Technological improvement carries with it, in all phases of business activity, one key element--change. In automation, because of its unlimited potential, the effect of change seems

¹Wesley S. Bagby, "Deciding Upon an Electronic Data Processing System," The Controller, XXIV (May, 1956), p. 218.

to be magnified. Both the personal and technical aspects of change confront business education today. Dr. Elvin S. Eyster, in an editorial, states that "education welcomes change but along with change comes many problems and challenges."¹ If the business educator is to meet the challenge of change, brought on by automation, he must keep abreast of the developments that affect business education.

Schools have not yet been affected to any great extent because, in the early development of automatic systems, industry looked to the manufacturers for re-training of old employees and the pre-induction training of new employees. Only as the movement toward automated accounting procedures stabilizes and becomes more general can the formal educational requirements involved in it be recognized and accurately evaluated.

Recognition of the impact and significance of automation appears to be slow among business educators. The businessman first looked upon automated equipment as devices for the engineer and statistician, the business educator has, for the most part, left education for employment in this field to the machine manufacturers. To illustrate this fact, it was not until 1956 that articles appeared under a separate heading of "Automation" in the Business Education

¹Elvin S. Eyster, "Significant Challenges to Business Education and Business," The Journal of Business Education, XXXIV (November, 1958), p. 58.

Index.¹ Prior to that time scattered articles appeared in business education publications and other listed publications under the headings of "Accounting," and "Office Machines." Increased interest in the past three years is seen in the increase in the listing of articles of interest to the business educator and articles written by business educators who have become concerned about automation. In 1956, 15 articles were listed in the Business Education Index under the heading "Automation;" in 1957, 30 articles appeared.

Even though attention given to automation has been limited thus far in public schools, one effect on the educational system is readily observable. Numerous educators have been hired away to work in the educational programs conducted by the machine manufacturers. Other business educators have gone into industry to teach or supervise in company training programs. It is apparent that only limited programs of preparation for machine accounting exist in the nation's schools. However, educators have moved into manufacturing and other business concerns to aid in preparing materials and conducting in-service educational programs.

To illustrate the educational offerings of the machine manufacturer, a brief discussion is presented here relative to the IBM Customer-Training Program. This program

¹Business Education Index, published annually by Delta Pi Epsilon Fraternity, through the Editorial Offices of the Gregg Publishing Division of McGraw-Hill Book Company, Inc., New York.

includes aptitude testing, multiple course offerings, and certificates of completion. The course offerings include basic instruction on the key-punch and other machines at the punched-card level, programming and operations of computers, punched-card accounting for executives, management of punched-card installations, and applications of punched-card procedures.

Aptitude tests are provided that measure aptitude for key-punching, machine operation, and electronic-data process-machine programming. These tests are available for use within a business concern for the purpose of selecting individuals to be trained in machine operations or given additional training to improve already existing skills.

Upon satisfactory completion of each class, a Certificate of Completion is granted to those individuals who achieved at levels of 70 per cent or better. Satisfactory completion is based on the scores achieved on a comprehensive examination given just prior to completion of the course. Failure to complete any course satisfactorily indicates that the student is not ready for more advanced study.

The educational facilities provided by the manufacturer are in some cases supplemented by company training programs indicated in a previous section of this chapter. In business concerns where large automated accounting units are found, extensive internal educational programs are conducted by supervisors and in some cases by individuals whose jobs are strictly that of instructing.

Through franchise arrangements with equipment manufacturers, a few private business schools and colleges are establishing courses in machine-accounting methods and numerous universities are starting computer courses. Also in a limited number of instances similar programs exist in high schools where instruction is given to potential key-punch operators.

It appears evident now that business will ultimately demand broader preparation of office workers to include a basic understanding of all business functions, mathematics of business, the relationships between operational units, and human relations. To begin to offer such training in the secondary schools seems to be logical step; however, offering of the specific preparation required in automatic machine operations may never be justifiable at the secondary-school level. The one factor that seems to restrict specific preparation at the secondary-school level of education is the extreme cost of the equipment essential to carrying out an adequate training program on machines used in automatic accounting systems.

It is the observation of the author that the same kind of resistance to change is evidenced among business educators that occurs in business organizations when a change to automation is envisaged. While in attendance at business education meetings, the author has observed that many business teachers, at both the collegiate and secondary-school

levels, express antagonism at the mention of anything that seems to out-date their present instruction circumstances either in content or method.

There appears to be no doubt that study, research, and careful evaluation regarding how best to prepare people relative to automation is necessary at this time. Only as extensive numbers of people become acquainted with automated equipment and adequately prepared to work with it can its full potential for good be realized.

Summary

In this chapter, an attempt has been made to present general background information pertinent to an analytical consideration of the effect of automation on the accounting phases of business enterprise and upon education for business. To give the reader of this report adequate preparation for analysis of the basic data, various ideas concerning automation in relation to accounting-data processing are pointed up. The ideas for the most part are from the literature written by experts in the field of automation and individuals who are actually in charge of automatic data-processing units.

In the first section of this chapter, material is presented relative to the historical development of automatic machines and systems utilized in accounting-data processing. The apparent impact of automation on accounting personnel and efficiency is discussed in the second section

with emphasis on such elements as: personal resistance to change, re-training and re-locating, and requirements for initial employment from the personnel viewpoint; and the ideas of more information available, speed and accuracy, and cost from the efficiency viewpoint. Finally, in this chapter ideas have been developed regarding the relationship of business education to automation. The emphasis here is on the formal training of individuals that may seek employment in business concerns utilizing automated-accounting systems.

The remaining chapters of this research study are devoted to presentation and interpretation of primary data. Based on the data, evidence is presented to substantiate many of the claims of individuals in business and industry as revealed in the various sections of this chapter.

CHAPTER III

COLLECTION OF DATA

This chapter constitutes a detailed description of the circumstances in which data were accumulated for this investigation. The basic technique utilized in the collection of the primary data was that of case study. For the purposes of this investigation, a "case" consisted of one installation of automatic equipment used in the processing of accounting information in one business enterprise. Each case study compiled for use in this research investigation includes a complete analysis and report of the status of a unit of automatic accounting equipment with respect to specific phases of the utilization of that equipment.

A case-study interview guide was utilized in the collection of the data. The data accumulated for each case study were analyzed, interpreted, and written up in the form of an individual case-study report. Forty-two installations of automatic accounting equipment, in 42 different business enterprises, are involved in this investigation. The 42 individual case-study reports constitute Appendix B. The case-study reports in Appendix B pertain only to the punched-card system of accounting, since, for all practical purposes,

this system is the only type of automation in existence in the accounting departments of business firms and governmental agencies in Oklahoma City.

General Circumstances Involved in
Collection of the Data

Oklahoma City is the largest city in the State of Oklahoma, located at the approximate center of the state. This city ranked forty-fifth in the nation in size in the 1950 census. The current estimated population is 425,000, based on figures released by the Public Relations Division of the Oklahoma City Chamber of Commerce.¹ The 1954 Census of Business indicates that there are 3,291 retail businesses, 808 wholesale businesses, 426 manufacturing businesses, and 2,256 selected services operating in Oklahoma City.²

The collection of the data for this study involved personal interviews conducted by the author with supervisors of machine-accounting installations. The interviews were conducted between February 12 and August 8, 1958. Each interview was scheduled by means of a telephone conversation between the author and the person to be interviewed. During the conversation, a brief explanation of the nature of the study and the types of information desired was related to

¹"Oklahoma City From A to Z," Duplicated report compiled by the Public Relations Division of the Oklahoma City Chamber of Commerce, (1958-59), p. 9.

²Edwin D. Golfield, ed., A Statistical Abstract Supplement County and City Data Book 1956, Bureau of the Census, United States Department of Commerce (Washington, D. C.: U. S. Government Printing Office, 1957), pp. 405-409.

the person to be interviewed, and a convenient time for a personal interview was established. Interviews were held between the fifth and twenty-fifth of each month to avoid the peak loads experienced in most business concerns around the first of each month.

Each personal interview was conducted in the office of the machine accounting supervisor for the particular business organization involved. In a majority of the cases, only the supervisor was interviewed; however, in certain of the cases, other personnel connected with the accounting operation of the business concerns also participated and made contributions which enhanced the case reports.

To establish uniformity in the collection of the data, each interview was conducted with the aid of an interview guide. Both general and specific questions were asked of the interviewees to ensure the accumulation of maximum amounts of data relative to the effect of automation on accounting activities. The time spent in conducting the interviews varied from 47 to 95 minutes. The amount of time required for the interviews was usually greatest in the businesses having the largest number of accounting personnel.

The Case-Study Sample

The sample utilized in this study was determined largely with the aid of representatives of the IBM and Remington Rand organizations. These two business organizations are the only producers and distributors of punched-card

equipment doing business in the immediate vicinity of Oklahoma City. In conferences with the representatives of IBM and Remington Rand, it was determined that there were 78 punched-card equipment installations in Oklahoma City. Each of these 78 installations involved at least the minimum amount of equipment for an installation. The minimum, defined for the purposes of this study, consisted of a key-punch machine and one other punched-card machine. Of the 78 installations, 70 involved IBM equipment and 8 utilized Remington Rand machines.

Company policies prohibited the IBM and Remington Rand Representatives from providing the researcher with actual lists of the 78 installations of punched-card equipment. Therefore, aid was solicited from certain members of the Oklahoma City Chapter of the Machine Accounting Association. All of the 78 installations were located as a result of the aid from the members of the Machine Accounting Association and conferences with the machine-company representatives. It was discovered that 49 installations were in private business offices while 29 were located in governmental agencies. Information relative to the number and nature of the enterprises involved in this investigation is revealed in Table 1. This table indicates the types of businesses utilizing punched-card equipment, the number of businesses in each classification, and the number from each classification for which case studies were accumulated in this investigation.

TABLE 1

BUSINESS ORGANIZATIONS IN OKLAHOMA CITY WHICH UTILIZE
PUNCH-CARD EQUIPMENT FOR ACCOUNTING FUNCTIONS

Type of Business Utilizing Punch-Card Equipment	Number of Installations in Operation	Number Involved in This Study
Government Agency	29	5
Wholesale Distribution.	14	10
Manufacturing	7	6
Insurance	6	5
Petroleum Production and Distribution	5	4
Public Utility.	5	3
Office Service Bureau	3	2
Common Carrier.	2	2
Banking	2	2
Education	2	0
Theater	1	1
Publishing.	1	1
Oil Field Service	1	1
Totals	78	42

Analysis of Table 1 denotes that exclusive of governmental agencies, there were 12 different types of businesses utilizing punched-card equipment. Of these 12 different types, wholesale distribution businesses, with 14 installations, were the leading private users of punched-card equipment. This number represents 28.6 per cent of the total of 49 installations located in private business offices. Further analysis indicates that 27 installations, or 55.1 per cent, were found in only three business types; wholesale distribution, insurance, and manufacturing.

Federal, state, county, and city governmental units were represented in the governmental agencies utilizing punched-card machines and procedures. The 29 agencies were comprised of two federal, 24 state, one county, and two city government installations.

The author made contact with the 78 punched-card machine units where case studies might be developed. A decision was then reached that certain of the 78 units were to be eliminated in the case study. The eliminations were based on two specific reasons: (1) the installations were too recent for opinions of effect to be formed by the personnel involved, and (2) the functions performed by the installations were not of an accounting nature. Using the foregoing criteria, 42 installations were finally selected for use in this study.

It is significant to note that one extremely large unit in one of the governmental agencies was omitted because of its enormity. This particular federal unit, Oklahoma City Air Materiel Area, Tinker Air Force Base (Tinker Field), functions as a world-wide data-processing unit for logistics in the United States Air Force. The automatic-machine operation involves up-to-the-minute inventory control. It processes information about the status, condition, and location of aircraft engines and maintains control over parts and supplies for aircraft throughout the operational limits of the United States Air Force.

In the total operation at Tinker Field, at the present time, there are approximately 550 persons employed in machine-accounting operations. This labor force includes approximately 370 people involved in punched-card machine operations, 150 people involved in electronic data-processing work, and 30 persons serving in administrative capacities. The machines that are utilized in this mammoth operation include:

- 80 Key-punch Machines
- 80 Verifiers
- 29 Sorters
- 31 Reproducers
- 25 Accounting Machines
- 37 Collators
- 16 Interpreters
- 1 Tape-to-card Converter
- 2 Large-scale Computers
- 1 Medium-scale Computer

It was assumed by the author that the extreme size and scope of the Tinker Field operation would distort the findings of this study which is primarily concerned with machine accounting in more nearly typical business organizations. Another research study, similar in nature to this investigation, might well be devoted only to an analysis of the utilization of equipment at Tinker Field.

The Interview Guide

One of the steps in the procedure for this investigation involved the preparation of a tentative interview guide and its utilization in a number of trial interviews to determine the availability of data and the adequacy of the

instrument. From the information obtained in the trial interviews, case-study reports were written relative to the individual accounting units. On the basis of this trial procedure, certain minor inadequacies in the interview guide were remedied. The interview guide was then revised to include more comparative data, and a division of topics to provide for logical consistency in the collection of the data and preparation of the case-study reports. Using the revised interview guide the author then interviewed appropriate persons in the 42 accounting units with which this investigation is concerned. The interviews resulted in the accumulation of data pertinent to the 42 accounting installations which was written up in the 42 case studies which constitute Appendix B of this research report.

The interview guide utilized in collecting the basic data for the case-study reports is presented in this section. So that the individual reader may readily understand how the interview guide was used and the types of information obtained in the personal interviews, the guide is filled in with the information from one of the cases.

Case Code Number 6Date May 14, 1958AFFECT OF AUTOMATION UPON ACCOUNTING JOBS¹Interview Guide

Name of Organization Wholesale Distributor "A"
Location Oklahoma City
Name of Person(s) Interviewed Mr. "X" and Mr. "Y"
Positions(s) Acting Manager of Machine Records — Program Director RAMAC

Company Operation: For 35 years a subsidiary of a major steel company. Under present ownership for 9 years. Houston, Texas, was original home office; moved to Oklahoma City five years ago. Has 45 store outlets in Texas, Oklahoma, Illinois, Arkansas, New Mexico, Colorado, Kansas, Louisiana, and Wyoming. Distributes oil field, mining, milling, and chemical supplies.

Volume of Business: 50 million dollars per year—gross sales.

Organization: Acting Manager of Machine Records functions directly under the supervision of the Head of the Accounting Department who is responsible to the Controller.

Name of the Machine-Accounting Unit Tabulating Section

Length of time this unit has been in operation 15 years

Number of employees in accounting and clerical jobs throughout the company 60 (this is a Home Office)

Number of employees in accounting and clerical jobs prior to machine installation 20 Total number of employees in all jobs in this organization 120 in General Office; 180 in Stores

Number of employees in the unit five years ago 6

Estimated number of employees that would be required to do manually what is now done by machine:

Many things now done by machine would not be done manually. Impossible to estimate.

¹The guide is in pica type; the filled-in data is in elite type.

Affect of machines on handling of peak loads as compared with doing work by manual methods:

No information available on which to base comparison with manual methods.

Affect of machines on over-time operations as compared with doing work by manual methods:

No over-time during regular work flow. Sometimes over-time if required in completing the fiscal inventory and preparation of cards.

Is the number of personnel adequate for current operations?

yes Why? No comment.

Number of additional personnel needed for unit to be adequately staffed: (indicate job classifications for needed personnel)

No comment.

What particular sources are used in obtaining personnel for this unit:

Department Head: If qualified person, promote from within the department; if not, hire from outside the company.

Supervisors: Same.

Key-Punch Operators: Sometimes promote clerical workers. Other times hire people recommended by IBM.

Accounting-Machine Operators: Hire people recommended by IBM.

Clerical Workers: Obtain people from other departments in the company or those recommended by IBM.

Others: No comment.

What is the promotion sequence in this unit?

No formal promotion sequence. Usually promote from a "I" classification to a "II" classification.

Case Number 6

Which of the following devices do you use in employee selection:

Application Blank yes What items are success indicators?
none Interview yes Who conducts the interview? Manager
of the Unit Tests yes What tests are used? Personality profile, intelligence, and IBM aptitude tests.

Reference yes Previous Employer? To some extent.

Character References no Physical Examination no

Are there physical handicaps that would eliminate employees?
Probably not. None have been involved thus far.

Affect of machine and automation developments:

Personnel:

Initial Employment Policies:

New employees generally start in lower classifications of jobs.

Promotion results from good work.

Basic Educational and Experience Requirements:

High school education is minimum. No specific high school subjects required. Machine Operator II must have at least one year of machine experience. No experience required of Key-Punch Operator.

Key-Punch Operators must attend IBM School. Machine Operators must complete IBM basic course in functional wiring.

In-service Training:

No specific planned program. Unit Manager has taught the 604 course to some employees.

Program Director attended RAMAC School. This was a special situation.

No special in-service training given in other departments of the company.

Personnel in the Machine-Accounting Unit:

Present Employees

Worker (Sex)	Job Classification	Time in Present Job	Time With Company	Initial Employment Classification	Education Attained	Source Initial Training	Prior Experience
1 M	Program Director for RAMAC	6 mos.	1 1/2 years	Manager, Machine Records Unit	Degree in Accounting	Tinker Field	1 yr. Tinker 1 yr. bus.
2 M	Acting Manager Machine Records	6 mos.	3 years	Clerk in Tab Room	31 hours in college	Bus. Col. IBM Sch.	None
3 F	Key-Punch Operator II	1 yr.	5 years	Key-Punch Operator I	High School	A State Instal.	Unknown
4 F	Key-Punch Operator I	2 yr.	2 years	Control Clerk	High School	IBM School	None
5 F	Key-Punch Operator I	1 yr.	1 year	Key-Punch Operator I	High School	IBM School	1 mo. IBM Ser. Bur.
6 F	Key-Punch Operator I	1 yr.	1 year	Key-Punch Operator I	High School	IBM School	Clerical
7 F	Key-Punch Operator I	6 mos.	6 mos.	Control Clerk	High School	IBM School	Clerical
8 F	Key-Punch Operator I	1 yr.	1 year	Key-Punch Operator I	High School	IBM School	None
9 F	Control Clerk	6 mos.	6 mos.	Learner	High School	--	Clerical

Case Number 6

Personnel in the Machine-Accounting Unit: continued

Worker (Sex)	Job Classification	Time in Present Job	Time With Company	Initial Employment Classification	Education Attained	Source Initial Training	Prior Experience
10 M	Machine Operator II	2 yrs.	3 years	Machine Operator I	High School	IBM School	None
11 M	Machine Operator II	1 yr.	1 year	Machine Operator II	3 years of college	IBM School	Govt. Instal.
12 M	Machine Operator II	9 mos.	2 years	Machine Operator I	High School	IBM School	Boeing at Wichita
13 M	Machine Operator II	3 yrs.	5 years	Machine Operator I	High School	IBM School	Ins. Cpy. 25 years
14 M	Machine Operator I	1 yr.	1 year	Machine Operator I	High School	IBM School	None
15 M	Machine Operator I	6 mos.	6 mos.	Machine Operator I	High School	IBM School	None
16							
17							
18							
19							

Case Number 6

Desired Qualifications for Each Job Classification

Job Classification	Personal Traits Especially Desired	Special Educational Requirements	Special Machine Preparation	Salary Range
Program Director for RAMAC	Even temperament, ability to get along with top management.	Degree in accounting is desirable	Experience in machine accounting is required.	\$ 475 to 595
Manager, Machine Records	Same as above.	Same as above.	Same as above.	388 to 493
Key-Punch Operator II	Ability to get along with fellow workers.	High school background. Typewriting desirable.	Key-punch school training necessary	240 to 300
Key-Punch Operator I	No special traits needed.	High school background.	Key-punch school training necessary	220 to 280
Machine Operator II	Good imagination, must be able to visualize effect of work done.	High school background.	Ability to operate basic machines and do wiring	305 to 385
Machine Operator I	Same as above.	High school background.	Same as above	240 to 300
Control Clerk	Neatness.	High school background.	Ability to operate adding machine	190 to 220

What were the functions of the machine-accounting unit at the time of installation?

Sales analysis was the first function for which the machines were utilized.

What changes have been made in the functions of the machine-accounting unit?

Function	Added or Eliminated	Effect on Personnel	Reason for Change
Accounts Payable	added	Normal attrition only.	Improvement in sending out statements.
Accounts Receivable	added	Two less people required in handling receivables.	Increased speed in handling items.
Inventory Control	added	Normal attrition only.	To achieve more rapidly and accurately control over inventory and handling thereof.

What changes are anticipated in the functions of the machine-accounting unit?

Function	Added or Eliminated	Effect on Personnel	Reason for Anticipated Change
Inventory of Furniture and Fixtures	to be added	None	Better check on furniture and fixtures through more complete records.
General Ledger	to be added	One person to be transferred to another position	Present equipment capable of more output. Speed.
Payroll	to be added	Two persons will be transferred	Same as above.

Operation of the Punched-Card Unit:

General: Women have been used exclusively as Key-Punch Operators.

Only men have been hired as Machine Operators.

Functions: Initially, the manual applications in sales analysis were taken over. Work in accounts payable, accounts receivable, and inventory control have been added.

Cost: Only new costs have been those involving the machine rental.

Accuracy: Clerks know they must be extremely accurate with the machine work. It is easy to find clerical errors.

Undercharges amounting to \$1,200 were caught by the machines.

Managerial Responsibility:

No comment.

Problems: Installation of the IBM equipment was no more difficult than buying a new desk calculator.

Personnel problems have been minor. Re-scheduling, training, physical elements sometimes difficult.

Time Factor:

No studies have been made of time savings. However, manual billing of Accounts Receivable required four days; now done in 10 hours.

General Comments: Individuals can learn processes only by working relatively long periods of time with the machines.

Best people now on the job came up through the ranks.

Unique Problems:

Problems of all facets of the company seem now to come to the machine unit for solving. This causes possibility of real over-loads unless the manager can say "no" occasionally.

Machines Used in the Unit:

Type of Machine	Number in Use	Per Cent of Time in Use	Purchased or Rented
Card Punch	4	75	rented
Verifier	2	75	rented
Sorter	3	42	rented
Collator	3	55	rented
Accounting Machine (tab)	3	63	rented
Interpreter	1	19	rented
Computing Punch	1	8	rented
Reproducer	1	46	rented
Accumulating Reproducer	1	72	rented
Calculator	1	14	rented

Manufacturer of major units of equipment I B M

Total purchase price — Rental \$4,294.50 per month

Special notations:

This organization is planning soon to install the first 305 RAMAC (Random Access Method of Accounting and Control) unit in the Oklahoma City area.

Example of A Case-Study Report

This example of a case-study report is presented here because the author realized that study and analysis of all of the reports would be a tedious and boring task. It is assumed that the reader, through study of the one case report, can readily understand how the 42 reports were developed. The entire group of 42 case-study reports is presented in Appendix B. The following formal case-study report is based on the data presented in the interview guide as indicated in the foregoing pages.

Case 6--Wholesale Distribution

This case involves the machine accounting unit of the home office of an oil field supply company. This company was a subsidiary of one of the major steel companies for 35 years prior to its purchase by the present owners nine years ago. The home office of this company was located in Texas until 1953 when it was moved to Oklahoma City.

There are 45 store outlets of this company operating in Oklahoma, Texas, Illinois, Arkansas, New Mexico, Colorado, Kansas, Louisiana, and Wyoming. An inventory of approximately 30,000 items is carried in each store consisting of oil field, mining, milling, and chemical supplies. The annual gross sales volume for all stores is approximately fifty million dollars. The total average number of employees of this company is 300. Of this number, 180 are employed in the stores, averaging four per store, and 120

are employed in the home office. The home office employees are divided equally between clerical and accounting personnel and general administrative personnel.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Head of the Accounting Department who is directly responsible to the Controller. An Accounting Manager of Machine Records is in direct charge of the unit. The unit is called the "Tabulating Section" at the present time, however, a request has been submitted to top management to change the name to "Electronic Data Processing Unit." The present Tabulating Section has been in operation for 15 years. Machines were first installed to fulfill the need for sales analysis. It was indicated by the person interviewed that at the time of the original installation this type of equipment was acquired with the idea that it was no more important than buying a new desk calculator. However, management soon changed its point of view and at present this unit is equipped with 20 tabulating and accounting machines with a rental charge of approximately \$4,300 per month. This company's Tabulating Section will also be the first IBM installation to utilize the "305 RAMAC" (Random Access Method of Accounting and Control) in the processing of accounting data.

Of the 60 employees in clerical and accounting jobs within the home office, 15 are employed in the machine

accounting unit; a program director for RAMAC, the manager of machine records, six key-punch operators, six machine operators, and a control clerk.

Machine accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs throughout the company due to the use of machines. However, an increase in the volume of business has required an increase from 20 employees in clerical and accounting jobs prior to machine installation to the 60 now employed. In the 15 years the Tabulating Section has been in operation, the number of employees has steadily increased from two to three in the first ten years of operation to the number currently employed. In the opinion of the manager, the 15 persons constitute an adequate staff for present operations. It is the conviction of the manager that any estimate of the number of employees that would be required to do manually what is done on the machines would be highly inaccurate and of very little value. This conviction is based on the fact that much of the accounting performed with the machines would not even be considered under manual accounting methods.

In this oil field supply company no over-time is required during the regular work flow and only occasionally during the time of taking a physical-count inventory.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was that

of sales analysis. The functions have been expanded to include accounts payable, accounts receivable, and inventory control.

The billing of accounts receivable became an added function when it was determined that sending out of statements could be improved through the speed of the machines. The billing procedure is accomplished in ten hours through use of punched-card equipment compared with four days using the old manual procedure. At the time that the Tabulating Section took over this function it was possible to transfer two accounts-receivable clerks to other departments within the company because of the reduced manual effort. The speed in handling accounts payable and control of the extensive and widely-spread inventory was also the basic factor in addition of these two functions.

At present this company is in the process of planning the adding of the functions of accounting for furniture and fixtures, payroll, and general ledger to the work of this unit. It is anticipated that no change in personnel will be required in adding the accounting for furniture and fixtures. This function is to be added to gain a better control of the equipment through better records. General ledger accounting and payroll accounting are now being performed on Burroughs Posting Machines. The decision to change to a punched-card procedure is based on the fact that the present equipment requires extensive maintenance, and the choice of

purchasing new manual equipment or the utilization of the punched-card equipment at no additional cost is obvious. This change will eliminate one person from general ledger accounting and two persons in payroll. These three individuals will be transferred to other jobs in the company. It is possible that one of the payroll clerks may be transferred into the Tabulating Section in the capacity of a payroll clerk.

Machine accounting personnel.--Of the 15 employees that constitute the personnel of the Tabulating Section, eight are men and seven are women. It was indicated that men are preferred as Machine Operators, women as Key-Punch Operators. Under the present organization, the following job descriptions were established.¹

Program Director for RAMAC: To coordinate all efforts when converting from the present machine operation to the RAMAC operation.

To obtain the essential facts on all reports and information desired from RAMAC by each section, division, and department.

To advise management on the possibility and economy of producing such reports.

To obtain from management certain decisions relating to the reports to be furnished.

To study the present accounting methods and procedures and through the Procedure Division effect those changes that are essential to the RAMAC operation.

To prepare complete procedures and flow charts on the RAMAC operation.

To program the RAMAC machine and from time available at a later date by IBM, test such program to insure management that the RAMAC will produce the results previously agreed on.

¹These job descriptions are not revealed in the interview guide on which this case-study report is based. The descriptions were provided in written form to supplement the interview material.

Manager, Machine Records: Organizes, supervises and coordinates the activities of the Tabulating Section in the preparation and keeping of records and tabulating reports, using punched cards and IBM machines and equipment to reproduce accounting information. Supervises the personnel activities of the section. Interviews prospective employees and hires or recommends hiring. Trains or supervises the training of new key-punch and tabulator machine operators. Recommends salary adjustments. Prepares and recommends approval of vacation schedules, sick and other leaves. Makes recommendations as to percentage of pay employees receive on leaves other than vacations. Checks or reviews work of key-punch and machine operators. Countersigns all weekly time slips. Instructs workers in new methods and procedural operations. Plans and devises operational methods and procedures. Prepares work schedules to maintain distribution and flow of work. Meets and advises with department heads and division managers to plan new machine accounting methods. Designs cards, forms, or reports for new machine accounting methods. Makes recommendations for purchase or rental of new IBM machines and equipment. Participates in all machine operations and performs other supervisory duties. Operates all IBM machines and equipment in emergencies or when necessary to maintain flow of work. Answers employees questions concerning work assignments. Checks all machines and equipment daily to insure proper maintenance and service. Makes necessary calls for IBM service. Keeps inventory of all supplies necessary for section operations. Prepares requisitions and orders to replenish supplies. Makes minor machine or equipment repairs and adjustments in emergencies. Maintains a daily work schedule of machine progress and report deadlines.

Key-Punch Operator II: In addition to duties of Key-Punch Operator I; supervises, coordinates, and assigns the work of key-punch operators, maintains the flow of work in accordance with prescribed policies and work schedules.

Supervises, coordinates, and assigns work of key-punch operators. Assigns work to operators on a priority, work-load, and line factor basis. Interprets changes in operational procedures. Instructs operators on procedures and answers questions concerning their work. Installs new operations as directed. Trains new employees on operational procedures.

Maintains production records. Prepares a weekly recap sheet of number of cards punched, by whom, number of errors and time utilized for key-punch and verifying operations for each operator. Totals cards punched,

cards verified, hours, and errors for each week. Records totaled information into ledger book. Performs a variety of general clerical duties as assigned.

Key-Punch Operator I: Operates a key-punch and verifying machine to record, code, and verify general accounting information for company record.

Prepares IBM tabulating cards of source documents for general accounting purposes; arranges documents in a specified sequence for processing. Prepares key-punch machine for operation. Selects and attaches proper skip-bar according to type of document being processed. Places blank IBM cards in magazine of automatic feeder, prepares a master or drum card according to the type of document being processed. Places master or drum card in the master rack or on the drum cylinder, depending on the key-punch machine being operated. Following information from the source documents, punches corresponding number or letter keys on the machine keyboard, transcribing information into punch-holes on the tabulating card. Prepares sufficient cards for each transaction to debit or credit the appropriate account.

Verifies accuracy of pre-punched tabulated cards: sight checks punched cards as to accuracy of master or drum card punch-holes. Prepares verifying machine for operation. Places punched cards in magazine of automatic feeder. Depresses skip-bar and places a card in the machine carriage for verifying operations. Following information from source material, depresses letter or number keys of machine keyboard in sequence to check and verify the accuracy of the punch-holes. Removes card from machine carriage if error(s) are detected. Marks errors and turns card face up or down in the stack, depending upon the verifying machine being operated. Re-punches or prepares a new card for incorrect one if necessary.

Operates an interpreter machine and keeps a daily record of work assignments: Places punched cards in automatic feeder. Starts machine which interprets and prints certain information from the punched holes along the top of the cards. Removes cards from machine and places them in file to await verification. Keeps a daily record of the cards punched or verified.

IBM Machine Operator II: Operates IBM tabulating machines and equipment that automatically transcribes data from punched cards, reproducing the information in printed form for accounting purposes.

IBM Machine Operator I: Under moderately close supervision performs moderately complex work in the

operation of various types of IBM machine record-keeping equipment to tabulate, sort, reproduce, and collate accounting and related records kept in card form.

Operates several of the types of punched-card machine accounting equipment such as a sorter, reproducer, collator, and interpreter to prepare and maintain operational records and accounting reports.

Performs simple changes in wiring control panel boards in the machines and makes simple adjustments to permit varied operations and to obtain accurate results.

Performs related duties such as filing, sorting, and assembling punched-card records.

Learner (Machine Records Section): Maintains a control ledger of all source documents by type of document, batch number, register number, merchandise, freight, tax total amount, cost, and card count processed in the section. Maintains the control ledger. Receives all source documents processed in the Tabulating Section. Checks and records identifying information, such as batch number, register numbers and total amount of source documents or attached adding machine tapes in the control ledger. Makes necessary corrections when discrepancies are found by telephoning originating section. Places source documents in file for processing by key-punch and verifying operators. Receives tabulated listing from tabular operators. Records merchandise, freight, tax, total amount, cost, and card count to control ledger. Compares total amount of source documents on tabulated list against total amount recorded in control ledger. Checks individual source documents against tabulated list in the event total amount in the control ledger does not compare with total amount on tabulated list. Files source documents in loose-leaf binders. Binds tabulated listings with metal fastener. Hand carries other source documents to proper department or division. Reconciles total amount of source documents processed monthly against tabulated reports of source documents processed. Using an adding machine totals entries in control ledger. Reconciles ledger totals with tabulated report totals. Carries a balance forward on accounts payable.

Performs related duties: sorts and arranges credit invoices in invoice number sequence. Prepares a daily summary report of sales invoices and cards punched. Hand carries summary report to Internal Accounting Division. Purges purchase invoice file monthly. Operates a key-punch machine when time permits. Performs miscellaneous duties as assigned.

The Program Director for RAMAC is a college graduate with a degree in accounting, however, none of his college work pertained to training in automatic-data processing specifically. His initial training on punched-card equipment was with the Federal Government in the Oklahoma City Air Materiel Area at Tinker Air Force Base. The experience of this person has been varied; he has one year's experience as an office manager, one year at Tinker Field as a punched-card equipment operator, a year and a half with the State Corporation Commission (where he set up their installation), and one year as Manager of Machine Records with this company. He has been in his present job for six months.

The Manager of Machine Records is a high-school graduate and is working toward a degree in accounting, having accumulated 31 college hours at the time of the interview. His initial training on punched-card equipment was through a local business college and the district IBM office. This person had no previous experience in machine work prior to his employment with this company. He has been in the employment of the company for three years; six months in his present job classification.

The Key-Punch Operator II is a high-school graduate and received her initial training while working in one of the state government installations. Her total experience includes several years on the key-punch while employed by the state, four years as a Key-Punch Operator I for this company, and one year in her present position.

In the Key-Punch Operator I job classification, five individuals are employed. All are high-school graduates and all received initial training in key-punch operations in the local IBM school. Only one of these five women had experience as a key-punch operator prior to employment in this company. She was employed for one month in the local IBM Service Bureau as a key-punch operator. One of the five had been an employee of this company for two years, three for one year, and one for six months.

In the Machine Operator II job classification, four individuals are employed. All are high-school graduates and one has completed three years of college work. All received initial machine operator training through IBM schools. Three of these four men had punched-card machine experience prior to employment with the company. Two of the four men were first employed in the Machine Operator I classification, the other two were initially employed in their present job classification. One of the four has been an employee of this company for five years, two for three years, and the other for one year.

In the Machine Operator I job classification, two individuals are employed. Both are high-school graduates and received initial training in the local IBM school. Neither of these two men had work experience on machines prior to employment in this company. One has been with the company for approximately one year; the other for six months.

The Control Clerk is a high-school graduate who has had no special training in the use of punched-card equipment. Her previous experience was of a general clerical nature. She was transferred into the Tabulating Section from the central office of the company.

Current employment practices.--Sources of personnel: New employees are hired at the job level in which there is a need. The sources of personnel for the Tabulating Section are the local IBM office and other departments within the company.

Selection devices: All persons who seek employment with this company are required to fill out an application blank containing general information. Personal interviews are conducted by the manager of the machine-accounting unit, who also makes decisions to hire. In this company, the personnel office administers a personality profile test and an intelligence test to each new employee. The IBM aptitude tests are also administered to all considered for employment in the Tabulating Section. References from prior employers are asked for but little or no use is made of them. There are no physical examinations required for the machine-accounting people.

Promotions and salaries: Promotion is generally from within and individuals are up-graded whenever possible as vacancies occur. Persons in other units of the company are sometimes promoted from lower-level clerical positions into

the control clerk position in this unit. The present manager was promoted in this manner; his immediate predecessor was brought in from outside the company. A person hired or promoted into the control clerk position is usually later promoted to the position of key-punch operator. In this connection, he must gain in-service training on the key-punch machine through attendance at the IBM school.

Information concerning the specific salaries for the 15 jobs in the Tabulating Section was not released. The manager did indicate the range of monthly salaries in all of the job classifications. They are as follows:

Program Director for RAMAC. . .	\$475 to \$595
Manager of Machine Records. . .	388 to 495
Key-Punch Operator II	240 to 300
Key-Punch Operator I.	220 to 280
Machine Operator II	305 to 385
Machine Operator I.	240 to 300
Control Clerk	190 to 220

The range in salaries reported for this machine-accounting unit indicates that probably the actual salaries paid are above average as compared with the information revealed by the salary survey made by the National Office Management Association for 1958 in Oklahoma City.¹

Qualifications of employees.--Personal traits: It was indicated by the manager of the machine-accounting unit that even temperament is a trait required of the person in

¹National Office Management Association, Office Salaries, A guide to 1958 Salary Rates Prepared by the National Salary Survey Committee (Willow Grove, Pa.: National Office Management Association, 1957), p. 19.

charge of such a unit. He stated that his unit has perpetual problems in that it is a focal point for difficulties encountered in every facet of the total organization. The personal trait emphasized for personnel in all job classifications was ability to get along with other people. Since persons in a machine-accounting unit work closely, and their work is combined in final output, this trait is essential. A good imagination and ability to visualize the effect of a job being done are also important.

Education: A high-school education is minimal. Typewriting is considered to be advantageous for key-punch operators but not a necessity. Bookkeeping is advantageous for machine operators but again is not considered as a necessity. It was the opinion of the manager of the unit that accounting training is essential in his work. Training in an IBM school is required of key-punch operators. Training in basic machine operation and in functional wiring is required of people employed as Machine Operators I and II.

Work experience: There is no prior work experience required of key-punch operators or machine operators in this company. However, to gain knowledge and skill required, individuals must attend the local IBM school for minimum instruction. A Machine Operator II is required to have at least one year of experience as a Machine Operator I, or its equivalent, prior to employment in that position.

In-service education: This company has no formal in-service education program. The manager of the Tabulating Section has conducted short courses for his personnel on specific machines or operations. Also, when time permits, persons are sent to the local IBM schools during working hours.

Machine utilization.--Production: The machines in use in the unit and per cent of time in operation are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (4)	75
Verifier (2)	75
Collator (3)	55
Sorter (3)	42
Accounting Machine (3)	63
Reproducing Punch	46
Interpreter	19
Calculator	14
Computing Punch	8
Accumulating Reproducer	72

These indications of machine utilization are based on the average of monthly production schedules.

Time and cost savings: A significant saving of time was reported but there have been no careful studies to establish definite dollar amounts or percentages of savings. It was reported that manual billing of accounts receivable formerly required four days to complete; whereas, at the time of the case study only ten hours were required with the use of punched-card equipment.

Accuracy factor: There were no records to indicate whether there was any significant improvement in accuracy.

However, based on statements concerning specific operations it is assumed that increased accuracy has meant definite savings. The "604 Calculator," for example, operating for only 14 per cent of the time in each month, more than pays for itself in improved accuracy of calculations--\$1,200 was discovered in undercharges in one short period. Also, clerical workers are working more carefully because they know that the machine process may disclose their errors.

Unique problems.--Re-scheduling of work, training of employees, allocating of physical space, and personnel relations were indicated as the major problems in this company in relation to the machine unit. It was emphasized that recruitment of young people for work in the machine-accounting field is one of the major over-all problems connected with the utilization of automated equipment.

Summary

This chapter has included a detailed description of the circumstances in which the data for the study were accumulated. Illustrations of both the interview guide and a typical case-study report were presented to give the reader an understanding of the procedures involved in accumulating the data and reporting of it. The 42 case-study reports which constitute Appendix B are summarized, interpreted, and compared in the following chapters to establish research validity concerning the effect of automation on employment in accounting occupations.

CHAPTER IV

ANALYSIS OF CASE STUDIES

This chapter constitutes a detailed analysis of data accumulated by means of the case-study technique described and illustrated in Chapter III. Information based on the data accumulated is synthesized, tabulated when possible, analyzed, interpreted, and summarized so that findings are clearly revealed. To facilitate the presentation, the material in this chapter is divided into sections in terms of general information, accounting functions, personnel factors, and machine utilization.

General Information

For the purpose of this study, general information is considered to be any of the data collected that are not directly concerned with specific accounting functions, personnel factors, or machine utilization. General information is presented here relative to the types of businesses utilizing punched-card equipment, volume of the businesses using the equipment, length of time punched-card equipment has been utilized, numbers of employees involved, and items concerned with organizational structure.

Types of Businesses

The utilization of punched-card equipment does not appear to follow any specific pattern with respect to the types of businesses using such equipment. The case-study sample, presented in Table 1, page 82, reveals that there are twelve different types of businesses along with governmental agencies utilizing automatic equipment in Oklahoma City in 1958. This study is directly concerned with 42 of the 78 punched-card installations in existence in Oklahoma City in that year. It is the belief of the author that consideration of the types of businesses represented in the total of 78 installations has value at this point.

Table 1 indicates that 49, or 62.8 per cent, of the 78 punched-card accounting installations in Oklahoma City were located in private business enterprises; 29, or 37.2 per cent, were located in governmental agencies. Of the 49 punched-card installations in private business, 27, or 55.1 per cent, existed in only three types of businesses: whole-sale, 14; insurance, 6; and manufacturing, 7. This distribution of the use of equipment does not necessarily mean that certain kinds of businesses find the use of punched-card equipment more advantageous than do other types.

The general literature and research concerning automation does not reveal a pattern in the kinds of businesses that utilize punched-card installations. There is currently no basis for comparing the types of businesses utilizing

punched-card equipment in Oklahoma City with types of businesses in other cities. However, it appears logical to assume that the businesses utilizing punched-card equipment to advantage in Oklahoma City may be the same kinds of businesses that utilize it extensively in other cities.

Volume of Business

The volume of business conducted by various business firms and governmental agencies involved in this study ranged from a gross income of \$500,000 to a gross income of more than \$100,000,000. The business firm represented by the latter figure is one which does business on a nation-wide basis with all gross income funneled to the Oklahoma City organization.

The average volume of business conducted by the 42 firms and agencies amounted to approximately \$30,000,000. However, this average figure is not particularly significant because volume above the low mark of \$500,000 seems to be no indication of need for automatic methods in accounting. The only generalizations that appear significant from this information are: (1) the very small businesses do not have their own installations of punched-card equipment, although, some do utilize equipment of other businesses on a service basis; and (2) there is no significant relationship between business volume and utilization of punched-card systems of accounting-data processing.

Time Equipment Has Been Utilized

Throughout the presentation of the background material in this study, it was emphasized that machine utilization is a relatively new phase of accounting. This fact is evidenced in analysis of the length of time punched-card equipment has been in operation in the 42 cases represented in this study. The data for this study were collected between February 12 and August 8, 1958. Machine installations had been in existence for various numbers of years as indicated in the following table.

TABLE 2

LENGTH OF TIME PUNCHED-CARD EQUIPMENT UNITS
HAVE BEEN IN OPERATION IN 42 ORGANI-
ZATIONS IN OKLAHOMA CITY

<u>Number of Years</u> <u>Units Have Existed</u>		<u>Number of</u> <u>Units</u>
Less than 1		4
1 to 3		9
4 to 6		10
7 to 9		6
10 to 12		9
13 to 15		3
More than 15		1

The one installation that has been in operation for more than 15 years was installed in 1941, 17 years prior to the time data were collected for this study. It is also interesting to note that 38 of the 42 installations were made since 1946 and that 23, or 54.8 per cent, were made in the past six years. It is apparent that most of the

development in machine accounting in Oklahoma City has occurred within the past 10 years.

Numbers of Employees Involved

Information was gathered concerning the total number of employees involved in the 42 business establishments in this study, the employees in accounting and clerical positions, and the employees working with the punched-card machines. In addition, information was obtained relative to the number of accounting and clerical employees employed prior to machine installations and estimates of the numbers of employees that would be required to do manually what is now accomplished through use of machines.

The total number of individuals employed in the 42 business concerns and governmental agencies included in this study was approximately 32,000. Of this number, approximately 4,500 individuals were employed in accounting and clerical positions. Of these 4,500 accounting and clerical employees, 406 were in various positions in the 42 machine-accounting units.

The information obtained relative to numbers of accounting and clerical employees indicates in almost all instances that the same numbers, or even greater numbers of individuals, are currently employed than were at work prior to installing of the punched-card units. The continued employment of individuals is explained by the fact that each

organization involved has experienced an increase in volume of business following the machine installation. Thus employment requirements have remained the same or have increased somewhat.

It is a matter of record that the ratio of production workers to office workers in the United States has decreased in the last three decades from approximately 9 to 1 to approximately 4 to 1. The ratio of total employees to accounting and clerical employees involved in this study is 7.5 to 1. This ratio is somewhat nebulous because of the variety of types of business and the vagueness of the specific job descriptions and classifications compiled in the case studies. In some of the business concerns, all personnel involved were considered to be office personnel. In certain other cases, all employees were classified as clerical and accounting personnel. The six cases representing strictly manufacturing concerns had ratios of production workers to other workers, including both office and distributive positions, ranging from 1.2 to 1 to 4.0 to 1. The figures here indicate that Oklahoma City is experiencing an increase in the per cent of office workers that is consistent with the experience of business and industry throughout the United States.

Ratio comparisons of total employees in specific business concerns to machine-accounting employees in those concerns ranged from a high of approximately 640 to 1 down to 1.5 to 1. The extreme variation in the ratios indicates

that the number of employees in an organization is not a basis for determining need for machine utilization.

A similar comparison can be made between the total numbers of employees in accounting and clerical positions and the numbers of employees in machine-accounting units. The range of ratios in this case was from 247 to 1 down to approximately 2.1 to 1. Here, again, the ratios do not seem to indicate any significant relationship relative to need for machines to facilitate the processing of accounting information.

The numbers of individuals employed in the 42 machine-accounting units comprising sources of data for this study are indicated in the following table.

Table 3

NUMBER OF PERSONS EMPLOYED IN 42 MACHINE-
ACCOUNTING UNITS IN OKLAHOMA CITY

<u>Number of Persons Employed</u>	<u>Number of Units</u>
1 to 2	4
3 to 4	6
5 to 6	10
7 to 8	6
9 to 10	4
11 to 12	3
13 or Over.	9

Further analysis of the information received in the case interviews shows that there was a total of 207 individuals in the nine firms having 13 or more employees in machine-accounting units. The other 33 business firms or governmental agencies employed a total of 199 individuals in their

machine-accounting installations. With 406 machine-accounting workers in 42 organizations, the average number is 9.7 per unit. However, a perhaps more meaningful average figure is that based on the 33 installations employing from one to 12 persons in positions in machine-accounting units. This average is 6.0 employees per unit. The 20 firms employing six or less people in machine units, employed a total of 89 persons, only 21.1 per cent of the total number of individuals actually working with punched-card equipment in the 42 case situations.

The comments concerning the number of employees that would be required to do manually what is presently done by machines included a wide variety of opinions. In some cases, the supervisors had very definite ideas and, in several instances, had presented to management comparative facts to illustrate the efficiency of the machine applications to accounting procedures. For example, in one of the public utilities a study revealed that a typist could complete 1,200 billings per day. To prepare the monthly billing of 4,230,000 separate accounts, in the 20 working days per month, approximately 177 girls would be required. The machine-accounting unit of this public utility firm performs the billing operation and many additional functions with only 35 employees.

The highest estimate of the requirement of additional employees to do manually what is now performed by punched-card equipment was 50 additional employees where 5 are now

employed; ten times as many. The lowest estimate was one more along with two now employed; one-half times as many. Certain supervisors declined to make estimates because of the many factors involved that affect estimates of this nature. These supervisors made statements indicating that with machines they were handling amounts of work and turning out reports that could not be done with manual methods. Thus, they believed attempts to compare numbers of employees required with machine and manual methods to be thoroughly impractical. Based on the estimates given relative to the number of additional persons that would be required to carry out the performance of the machine-accounting functions utilizing manual methods, it appears that approximately three to four times the number employed to process accounting data by machines would be a reasonable estimate.

From the foregoing presentation of data pertaining to numbers of employees in the business concerns and governmental agencies comprising this research study, three somewhat significant generalizations may be made: (1) comparisons of employees by types of work performed can not be used as a basis for determining the effect of automation on employment in accounting positions, (2) fewer individuals are needed to perform the processing of similar kinds of accounting data by machine than by manual methods, and (3) there have been few if any reductions in the total number of employees in business concerns or governmental agencies as a result of automated data-processing equipment.

Organizational Structure

In the 42 cases representing both private business concerns and governmental agencies, individuals in a variety of classifications are charged with administrative responsibility for the machine units of their companies or agencies. In several cases, administrative officials with responsibility for machine applications were directly in charge of the operation of the machines; in other cases as many as three organizational steps linked the actual machine operations with the individuals responsible. Table 4 constitutes a summary of the descriptive titles used to describe the persons supervising the operational aspects of the units.

TABLE 4

DESCRIPTIVE TITLES OF INDIVIDUALS IN CHARGE OF 42
MACHINE-ACCOUNTING UNITS IN OKLAHOMA CITY

<u>Descriptive Title</u>	<u>Number of Units</u>
Supervisor of Machine Unit	25
Manager of Machine Unit.	4
Head of Machine Unit	2
Chief of Machine Unit.	2
Office Manager	2
Division Supervisor.	1
Sales Manager.	1
Chief Accountant	1
Director of Accounting	1
President.	1
Purchasing Agent	1
Superintendent	1

In the 42 cases, 12 different titles were used to designate the persons supervising the operational aspects of the machine-accounting units. The first four designative

titles, representing 33 cases, imply that persons in direct charge of machine operations devote full time to their machine units. In the remaining nine cases it is apparent from the descriptive titles, that the individuals have other administrative duties which perhaps require as much or more of their time than does the administering of the punched-card units.

The internal structure of organizations causes machine-accounting operations to be integrated in existing organizational units or be developed in separate units. In the 42 cases in this study, 13 units were integrated parts of other units and 29 were established as separate units. Twenty different names are used to designate the various units involved in this study. The names in some cases reflect the kinds of machines used and in other cases reflect specific functions performed by the machines. Table 5 presents the descriptive names used in referring to machine-accounting units and the number of firms using each name. The information in the table indicates that in 25 of the 42 units, the machine-accounting operation is considered to be departmental and the names involved convey that designation. In the remaining 27 cases, 15 different organizational unit designations are used.

Lack of uniformity in descriptive names appears to be a general characteristic of automated-accounting units.

TABLE 5

DESCRIPTIVE NAMES OF 42 MACHINE-ACCOUNTING
UNITS IN OKLAHOMA CITY

<u>Descriptive Name</u>	<u>Number of Units</u>
IBM Department	9
Machine-Accounting Department.	6
Tabulating Department.	5
Machine Room	3
Tabulating Section	2
Data-Processing Department	2
General Office	1
Machine-Accounting Division.	1
Perpetual Inventory Department	1
Records Department	1
Accounts Receivable Unit	1
Machine Records Department	1
IBM Section of Research and Statis- tical Division.	1
Sales Accounting Unit.	1
Tab Room	1
Public Accounting System	1
Machine Records and Medical Statistics Unit	1
Tabulating Equipment Planning and Operations Section.	1
Tabulating and Production Control Unit.	1
Machine-Accounting Organization.	1
Machine Billing and Accounting	1

Accounting Functions Fulfilled by Machines

Specific functions fulfilled by machines in the 42 business organizations involved in this research report are considered here in terms of the functions performed at the time of the installing of the machines, additions to the original functions, anticipated changes in functions, and various reasons for utilization of punched-card equipment.

Function(s) at Time of Installation

An analysis of the number of functions that were initiated on the machines at the time the 42 business concerns or governmental agencies first installed punched-card equipment indicates that: 24 started with one function, 13 started with two functions, three started with three functions, one started with four functions, and one started with five functions. Table 6 indicates the types of functions performed initially by the punched-card installations surveyed and the number of units in which each specific function was the initial operation or one of the initial operations.

TABLE 6

ACCOUNTING FUNCTIONS PERFORMED INITIALLY BY
42 ACCOUNTING UNITS IN OKLAHOMA CITY

<u>Accounting Functions</u>	<u>Number of Units</u>
Functions Associated With Accounting:	
Billing	18
Inventory Control	8
Payroll	7
Accounts Receivable	6
Revenue or Sales	4
Invoicing	3
General Ledger	3
Cost	1
Check Writing	1
Functions Auxiliary to Accounting:	
Statistical Reports	5
Sales Analysis	2
Trust Accounting	2
Service Bureau Operation	2
Expense Distribution	1
Assessment and Tax Roll	1
School Census and Pupil Accounting	1
Requisitions	1
Purchase Orders	1
Labor Distribution	1

It is obvious that in many cases the descriptive words indicated in Table 6 for the functions performed are different, whereas, the actual accounting functions may be the same. For example, billing, invoicing, and sales accounting are all types of billing operations. Thus, it is evident that the descriptive names used to label specific functions may be misleading when comparisons are made between various machine-accounting units and systems. It should also be noted that the functions performed by a punched-card accounting installation may be peculiar to the type of business concern or governmental agency involved.

Additions to Original Functions

In the 42 units that make up this study, 27 made additions to their initial machine-accounting operation; 15 are still performing only the original functions for which equipment was installed. In the 27 units adding functions, two added all accounting functions except the general ledger. The other 25 units of this group added as follows: three units added three functions, eight added two functions, four added four functions, and five units added five functions. The total number of functions added in these 25 units was 75. Thus, three functions, on the average, were added to the initial basic function for an average total of four. In Table 7 are presented the designations used to describe the functions added in the various units as the work-loads were stabilized.

TABLE 7

FUNCTIONS ADDED TO THE WORK-LOADS OF 42 ACCOUNTING
UNITS IN OKLAHOMA CITY AS USE OF PUNCH-
CARD EQUIPMENT WAS STABILIZED

<u>Additions to Initial Functions</u>	<u>Number of Units Adding Each New Function</u>
Functions Associated with	
Accounting:	
Accounts Receivable	10
Payroll	8
Accounts Payable.	6
Inventory Control	5
Check Writing	3
General Ledger.	2
Accounting for a Subsidiary . .	2
Furniture and Fixtures.	2
Monthly Report to Parent	
Company.	1
Invoicing	1
Functions Auxiliary to Accounting:	
Sales Analysis.	4
Statistical Analysis.	4
Tax Receipts.	3
Expense Analysis.	2
Trust Accounting.	2
Company Mailing List.	1
Employment Histories.	1
Commissions Records	1
Automobile Records.	1
Safety Deposit Box Inventory. .	1
Call Schedule for Bonds	1
Jury List	1
Labor Distribution.	1
Actuarial Records	1
Route Listings.	1
Legal Cash Reserves in Force. .	1
Claims Reports.	1
Records of Shipments.	1
Credit Card Records	1
Lease Hold Records.	1

Analysis of Table 7 indicates that in many instances very similar functions carry different descriptive names.

Also, it should be noted that many of the functions added are the same as the initial functions presented in Table 6. However, in many of the added functions there are indications of special unique aspects applicable to specific types of organizations, and fringe operations that would not be feasible to complete through utilization of manual methods of accounting.

Combining the 68 functions originally planned for, as presented in Table 6, and the 75 added functions presented in Table 7, a total of 143 functions are currently being performed by the 42 punched-card accounting-data processing units involved in this study. This is an average of approximately 3.4 different functions performed in each unit. It seems apparent that one of the characteristics of punched-card equipment utilization is the adding of functions as procedures become stable and time, personnel, and machines can be made available for additional work.

Anticipated Changes in Functions

To illustrate further the point that machine usage can be expanded as the procedure for each existing function is stabilized, the anticipated changes in the machine-accounting units are reported. Of the 42 units involved, 29 were preparing for changes within the year; 20 by adding more functions to the current operations, and nine by changing equipment or basic procedures.

The anticipated changes in functions indicated in Table 8 are those which the machine supervisors expected to make soon. Certain business firms were adding functions that are already being performed in other cases. In certain cases, the indications are that machine utilization has reached the point where needs of non-accounting departments can be met as machines are used to carry on functions beyond the usual scope of accounting.

TABLE 8

FUNCTIONS WHICH IT IS ANTICIPATED WILL BE ADDED TO THE
WORK-LOADS OF 20 ACCOUNTING UNITS IN OKLAHOMA CITY

<u>Functions to be Added</u>	<u>Number of Units That Will Add Each Function</u>
Functions Associated With Accounting:	
General Ledger	3
Payroll.	2
Accounts Payable	2
Inventory Control.	2
Furniture and Fixtures	1
Figuring Profit.	1
Accounts Receivable.	1
Check Writing.	1
Central Billing.	1
Property Accounting.	1
Cost	1
Functions Auxiliary to Accounting:	
Claims Distribution.	1
Subsidiary Billing	1
Installment Loans.	1
Aircraft Control	1
Dividend Records	1
Labor and Transportation Records	1
Expansion of Current Operations.	1
Functions Apart From Accounting:	
Engineering Department Clerical Work	2
Student Registration	1
Mailing Operation.	1

Seven of the 29 organizations planning installation of new equipment or additions to their present punched-card equipment anticipate increased operational efficiency in their machine-accounting units. Five of these companies are changing to IBM's "305 RAMAC" machine. This is a random-access machine, which means that items of information that are desired may be searched out of storage in a random order for further processing. One company has ordered a new series of IBM punched-card equipment, known as the "50 Series," to replace a card-a-type operation. The IBM, "50 Series," machines perform the same operations as the regular IBM equipment but operate at slower speeds and rent for much less. Another business concern is adding a small computer, the IBM "604 Series" component punched-card machine, so that functions requiring extensive computations may be performed in addition to the present operations. Two of the business concerns represented in this study are currently preparing for installation of complete integrated data-processing systems.

Reasons for Utilization of Punched-Card Equipment

On the basis of analysis of the interview comments made by supervisors of the 42 machine units relative to why machines were installed and analysis of the functions actually being performed, it became evident to the author that two major reasons exist for the installation of punched-card equipment. The first of these is reduction of unit costs in

the processing of accounting information. Reduction of unit costs has long been a matter of concern in production and manufacturing, and in recent years has become important in the thinking of businessmen regarding office operations. The second major reason for installing equipment has been to improve efficiency in the processing of accounting information. In effect, improvement in efficiency results in the more rapid completing of accounting functions, along with providing increased amounts of accounting data for use by management.

In the interviews, supervisors of units made a variety of statements depicting reasons for utilization of punched-card equipment but analysis of the statements emphasizes only the two elements mentioned above. In view of this emphasis, no attempt is made to present in tabular form the numerous and extremely varied specific stated reasons for utilization of the punched-card level of automation. In the comments made by unit managers, reduced cost and improved efficiency were indicated in terms of the points of view that machine utilization: (1) facilitates processing of increased business volume, (2) provides information not available by manual methods, (3) allows for a reduction in personnel, and (4) simplifies processing of extensive detail.

In three cases, unique reasons warranting special mention were given for machine installations. In one wholesale distribution company, punched-card machines were

installed as a result of a special agreement with the machine manufacturer. The company involved handles a product that is distributed on a nation-wide basis. The machine distributor makes punched-card equipment available at reduced rates to the franchised dealers of the unique product. It was reported to this researcher that if regular prices had been charged, the machines would not have been installed. In another case, again a wholesale distribution company, the president of the concern became impressed with what punched-card equipment could do and arbitrarily decided that it was something his company needed. Lack of complete planning in this case caused many problems in the first two years of the operation of this unit. Too many applications of a large card volume were started, causing delay in billing accounts receivable and almost complete chaos in perpetual inventory. The third case, in which a bank is involved, reported that one of the reasons for installing punched-card equipment was the prestige benefit gained from the improved appearance of reports sent to customer banks.

The same major reasons evident at the time of installing of punched-card equipment are usually present when functions are added and changes anticipated. However, in two business firms unique reasons relating directly to increased efficiency of machine methods over manual methods were reported in this study. In one case, because machine time was available, functions were added merely to gain full machine

utilization; no special advantage was expected. In the second case, available machine time was used to add work that had been contracted outside the firm when manual methods were used.

When machine-accounting units were installed, there were in most cases general shifts in positions without reductions in the numbers of clerical and accounting personnel. In one company, where the specific stated reason for machine utilization was that of reducing personnel, the actual installation resulted in no one being released from employment. In all of the 42 case studies, only 22 individuals were reported as actually leaving jobs, either directly or indirectly because the accounting-data processing was automated. At the same time, it should be noted that all but 12 of the 22 individuals could have been transferred to other positions within the companies had not peculiar circumstances been involved. In six instances, no-marriage rules eliminated the individuals, in two instances the individuals quit rather than be transferred, one person had previously contemplated leaving for personal reasons, and another was given a leave of absence and did not choose to return at the end of the leave. In all other cases where a reduction in personnel was experienced, economic factors were the cause rather than utilization of punched-card equipment.

Personnel Factors

Personnel factors relating to 406 individuals employed in the 42 business and governmental machine-accounting units comprising this investigation are considered here under three subheadings: machine-accounting personnel, current employment practices, and qualifications for employment.

Machine-Accounting Personnel

This material concerns job classifications, job descriptions, educational attainments, and the total work experience of the 406 individuals that were considered to be machine-accounting personnel in the 42 units involved in this study. In each case report where complete information was available, a sketch was developed of each person's educational background and experience as related to his job. At this point, the information from the case studies is summarized.

Job classification.--Analysis of the number of job classifications in the 42 cases representing both private business concerns and governmental agencies, revealed that 41 different descriptive titles were used to designate the job classifications of machine-accounting personnel. In some instances, several descriptive titles were used for jobs involving substantially the same duties. For example, such titles as machine operator, tabulating machine operator, tab operator, and accounting-machine operator were all

used with individuals having very similar duties and sometimes operating identical machines. In certain instances, specific job titles were applied to clerical workers in the machine-accounting units. For the purpose of discussion in this study, the following titles for nine specific jobs were selected as most appropriate:

supervisor	control clerk
chief operator	programmer
machine operator	card-a-type operator
key-punch operator	general clerk
verifier operator	

Under the classification of supervisor, all individuals having duties involving direction of the work of others are included. Under the classification of machine operator all individuals who operate the machines in a punched-card installation, other than the key-punch machine, are included. All other job classifications are in themselves descriptive of the type of work performed by the individual with each title. The general job classifications and the number of individuals in each classification are presented in Table 9.

Analysis of information relative to the sex of the 406 individuals in the 42 machine-accounting units, revealed that 149 were men and 257 were women. A definite preference for men in the supervisors' positions is indicated with 48 men and 5 women employed. Among the machine operators, there were 87 men and 28 women. Conversely, there were 136 women employed as key-punch operators while no men held that job classification. Among the remaining seven job

classifications, there appeared to be no general preference relative to the sex of employees.

TABLE 9

NUMBER OF PERSONS IN SPECIFIC JOB CLASSIFICATIONS
IN 42 MACHINE-ACCOUNTING UNITS IN OKLAHOMA CITY

<u>Job Classification</u>	<u>Number of Individuals</u>
Supervisor.	53
Chief Operator.	11
Machine Operator.	116
Key-Punch Operator.	136
Verifier Operator	8
Control Clerk	5
Programmer.	3
Card-a-type Operator.	6
General Clerk	68
Total	406

Job descriptions.--In only six of the 42 machine-accounting units in this study were formalized written descriptions of jobs made available to the author. In five additional units, formal job descriptions were used but were not made available to persons outside the companies or agencies. In 31 cases no formal attempts had been made to prepare specific job descriptions.

The formalized job descriptions are contained in cases numbered 3, 5, 6, 22, 33, and 37 in Appendix B. It is the belief of the author that presentation of the complete job descriptions at this point is unnecessary. Two illustrative descriptions are indicated here to show the typical kinds of information that are included:

Machine Operator: Operates a machine that automatically analyzes, makes calculations and translates or divides information represented by holes punched in groups of tabulating cards, and prints the translated data on form sheets, reports, special cards or accounting records. Sets or adjusts machine to add, subtract, multiply, and make other calculations. May operate auxiliary machines.

Key-Punch Operator: Records accounting and statistical data in tabulating cards by punching a series of holes in specified sequence, using a key-punch machine. May operate a verifying machine.

The numerous other formal job descriptions provide essentially the same kinds of information in very similar format.

Education of personnel.--The educational backgrounds of the 406 employees are considered here in terms of amounts of formal education completed by individuals in the job classifications established in Table 9. This information is summarized in Table 10.

Analysis of the information in Table 10 indicates that 25, or 6.2 per cent of the employees in the 42 machine-accounting units were college graduates; 40, or 9.8 per cent had acquired some college credit; eight, or 2.0 per cent had attended private business colleges; 305, or 74.4 per cent terminated their formal education with graduation from high school. The extent of formal education possessed by the employees involved in the units indicates that a high-school education is a basic requirement for employment. No additional educational requirement is apparent in Table 10. Even though a significant number of the employees had

completed college degree requirements, or had completed some college work, there is little or no basis for assuming that a college education is a definite requirement for even the supervisory positions in machine-accounting units.

TABLE 10
EDUCATIONAL BACKGROUNDS OF 406 EMPLOYEES IN 42
MACHINE-ACCOUNTING UNITS IN OKLAHOMA CITY

Job Classification	Level of Formal Education				
	College Degree	Some College	Business College	High School	Un-known
Supervisor.	14	14	6	16	3
Chief Operator. . . .	1	3	-	6	1
Machine Operator. . .	8	20	1	77	10
Key-Punch Operator. .	1	2	-	120	13
Verifier Operator . .	-	-	-	8	-
Control Clerk	1	1	1	2	-
Programmer.	-	-	-	1	2
Card-a-type Operator.	-	-	-	6	-
General Clerk	-	-	-	66	-
Totals.	25	40	8	302	31

The sources of initial training on punched-card equipment of the 329 individuals in supervisory or machine operators jobs are shown in Table 11. This table presents the sources of training reported in the interviews and the number of persons who received initial training through each source.

The data in Table 11 indicate that on-the-job training and training opportunities offered by punched-card

equipment manufacturers and distributors are the two primary sources of instruction on this type of equipment at the present time. Of the 329 individuals having gained knowledge of the operation of punched-card equipment, 283, or 86.1 per cent, received their initial training through on-the-job training or manufacturer's training courses. It appears that the offering of instruction in the operation of punched-card equipment through other types of educational arrangements or facilities is indeed limited.

TABLE 11

SOURCES OF INITIAL TRAINING OF 329 EMPLOYEES IN 42
MACHINE-ACCOUNTING UNITS IN OKLAHOMA CITY

<u>Source of Initial Training</u>	<u>Number of Employees</u>
On-the-job Training.	192
Manufacturer's Training Course	91
Armed Service School	6
Private Business College	6
College or University Course	3
Source Not Known	31

Work experience.--The work experience of the 406 employees is considered here in terms of the number of years with the company, number of years in current position, and number of years of punched-card experience. It is the belief of the author that a detailed tabulation of the 406 employees by job classification and number of years of experience is not essential here. Therefore, information relative to work experience is presented only in terms of average numbers of

years in each job classification. This information is given in Table 12.

TABLE 12
WORK EXPERIENCE OF EMPLOYEES IN 42 MACHINE-
ACCOUNTING UNITS IN OKLAHOMA CITY

Job Classification	Average Number of Years With Company	Average Number of Years in Current Position	Average Number of Years of Punched-Card Experience
Supervisor.	8.9	4.4	9.0
Chief Operator.	6.2	1.6	5.7
Machine Operator.	3.5	3.0	3.6
Key-Punch Operator.	4.1	2.9	4.2
Verifier Operator	4.3	2.9	3.0
Control Clerk	7.8	4.0	-
General Clerk	2.9	2.4	-
Card-a-type Operator.	1.7	1.2	1.2
Over-all Averages	4.3	3.0	4.9

It was emphasized in several of the interviews that from two to three years is the usual tenure of machine operators and from one to two years is common for key-punch operators. Information in Table 12 indicates that the average machine operator has held his job for exactly three years. The average time key-punch operators have held their jobs is 2.9 years. The latter figure is somewhat at variance with the idea emphasized in certain of the interviews. The most significant fact indicated by the data in Table 12 is that all averages of years of work experience in the various job

classifications are quite low. This is another indication of the relative newness of punched-card operations in the accounting field.

Through comparison of initial employment classifications with current employment status, it is possible to gain a limited concept of hiring and promotional patterns. The information in Table 13 constitutes such a comparison. It may be observed that 166, or 50.5 per cent, of the individuals involved were initially employed in their current job classifications; 134, or 40.7 per cent, were initially employed at levels below their present job classifications; in 28 cases, this information was not obtainable. It is interesting to note that the one remaining individual is currently employed in a classification below that for which she was initially hired. This is true because a change in equipment was made wherein it was necessary for this woman to drop back one step in job status.

The information in Table 13 indicates that in the business concerns and governmental agencies comprising the sample for this study two basic approaches to securing personnel for machine-accounting units are utilized. One approach is to hire experienced machine operators and the other is to promote from within certain individuals with company experience. Approximately the same number of organizations have been enabled to use the first approach as have used the latter. The information given here indicates that

up-grading in machine operator job classifications occurs only infrequently. To illustrate, of the 105 machine operators, whose initial employment classification was known, only four were initially employed below the machine operator classification as key-punch operators.

TABLE 13

COMPARISON OF INITIAL AND CURRENT EMPLOYMENT
CLASSIFICATIONS OF 329 EMPLOYEES IN
MACHINE-ACCOUNTING UNITS IN OKLAHOMA CITY

Initial Job Classification	Current Job Classifications and Number of Individuals in Each					
	Supervisor	Chief Operator	Machine Operator	Key-Punch Operator	Verifier Operator	Card-a-type Operator
Supervisor	17	-	-	-	-	-
Chief Operator	-	1	-	-	-	-
Key-Punch Operator	-	1	4	70	4	-
Machine Operator	9	7	68	1	-	-
Verifier Operator	-	-	-	-	4	-
Card-a-type Operator	-	-	-	-	-	6
General Clerk	23	1	15	51	-	-
Other (special)	2	-	18	-	-	-
Unknown	2	1	10	14	-	-
Totals	53	11	115	136	8	6

The 20 individuals in the initial job classification of "Other (Special)" in Table 13 were employed in jobs

peculiar to the type of business concern or governmental agency in which the individuals were working. Although attached to the machine-accounting units, these people were working at jobs involving such things as meter reading, service activities, warehouse activities, and so forth.

Current Employment Practices

The employment practices presented here in terms of sources of personnel, selection devices, promotion, and salaries are based on the current policies of the 42 business concerns and governmental agencies comprising the study sample.

Sources of personnel.--In general throughout the 42 business concerns and governmental agencies new employees are hired for office jobs at the job level in which there is immediate need. This generalization is demonstrated in Table 13, where information is summarized relative to initial job classifications of individuals employed in the machine-accounting units involved in this study. To inquiries concerning sources of potential employees, responses were given indicating 13 different sources. In Table 14 the sources of employees used in the 42 machine-accounting units are indicated.

It should be noted that the local IBM and Remington Rand offices do not have specific placement bureaus for individuals trained in the operation of their equipment. However,

they do maintain lists of individuals who are seeking employment or desire changes in employment. This is done only as a convenience to their clientele and no service charges are made. Much the same thing is indicated in Table 14 as in the analysis of initial training. Currently, machine manufacturers are the main sources of individuals trained in punched-card phases of automatic-data processing. The 22 units indicating that this source of employees is utilized, represents 52.4 per cent of the 42 cases.

TABLE 14

SOURCES OF POTENTIAL EMPLOYEES FOR 42
MACHINE-ACCOUNTING UNITS IN OKLAHOMA CITY

<u>Source of Employees</u>	<u>Number of Units Having Used Each Source</u>
Machine Manufacturer.	22
Private Employment Agency	15
State Employment Agency	13
Within the Company.	13
Classified Advertisement.	7
Supervisors in Other Companies.	6
National Association of Machine Accountants	2
Referred by Another Worker.	2
Voluntary Application	1
College Placement Service	1
Civil Service Register.	1

Selection devices.--The details of selection procedure, from necessity vary from organization to organization. In some concerns it may be very simple, in others it may involve several steps. However, it is a generally-accepted fact that there are five basic steps in selection: the

application, the interview, testing, checking of references, and the physical examination. The foregoing selection elements are considered here in terms of the extent to which each is involved in selection of employees in the 42 machine-accounting units.

In 37 of the 42 units all persons who seek employment are required to fill in application blanks containing general information. Four supervisors indicated that, in their opinions, certain factors constitute employment "success indicators." Each of the four men indicated that he relied most upon one of the following factors: (1) experience, (2) 10-key adding-listing machine and typewriting skills, (3) ability to follow instructions, and (4) weight. Each unit supervisor relied on only one of the four indicators and was not concerned about the others. In the single case involving reliance upon ability to follow directions, the judgment was made only in terms of the appropriateness with which the general information blank was completed. The weight of each applicant was a determining factor in one unit because in that particular installation the work area is extremely limited and large persons actually take up too much space.

Interviews are conducted with applicants in all of the 42 units. In 26 cases, personnel interviewers or administrative officials conduct the initial screening interviews and the supervisors of the machine-accounting units conduct interviews only with the most likely applicants. In 16

cases, only one interview is conducted with each applicant. In seven of the 16 cases, the interviews are conducted by personnel interviewers or administrative officials; in nine cases the machine-accounting supervisors conduct the interviews and make direct recommendations concerning which persons should be hired.

The use of tests of various types is currently a standard procedure in employee selection. However, in only 25 of the 42 machine-accounting units are tests of significance. There appears to be no basic pattern in the use of tests. In some instances one type of test is utilized and in others complete batteries are considered necessary. The information pertaining to the administration of testing programs also did not indicate any generally-accepted procedure for testing. In some organizations the personnel departments administer all tests. In other cases, individuals are sent to the local IBM office or the state employment service office for testing. In still other cases, the tests are administered by the machine-accounting supervisors. The tests utilized most frequently are the IBM aptitude tests, for both key-punch operators and machine operators. Other types of tests used include: general clerical, general intelligence, general aptitude, personality, and civil service. In a few cases, operational tests are utilized such as typewriting performance, punched-card machine operation and wiring, and trial runs on the punched-card machines. It is true that an

individual classified as a machine operator in a large installation may operate only one particular machine. This fact has prompted one supervisor to devise objective tests to measure knowledge possessed relative to each particular machine in his unit.

It is a generally-accepted procedure to request from individuals seeking employment the names of individuals who can and will provide information concerning previous employment or character. Of the 42 machine-accounting units, 29 use both previous employment and character references in their selection procedures. Of the remaining 13 units, 11 request only references from previous employers, while in two units no references are required. It should be noted at this point that once the applicant has reported references on the application blank the use made of those references varies from a very thorough check--in one instance finger printing and a police record check--to very little, if any, consideration of them. In several instances it was specifically emphasized that very little faith is placed in the references given by individuals seeking employment.

The final selection device in many employment situations is the physical examination. In the 42 units involved in this investigation, 19 require physical examinations of individuals seeking employment. Utilization of the physical examination as a selection device carries two generally-accepted points of view: (1) that the physical

examination is regarded as a hurdle that will eliminate from employment those individuals with weaknesses, and (2) that the physical examination is a device that is useful in discovering what job the individual is best qualified to fill. It is the opinion of the author that the first point of view prevails in the utilization of physical examinations for employment in punched-card accounting positions. The basis for this opinion is the fact that in a machine-accounting unit an individual is required to lift and carry file drawers of cards in the performance of his duties. Also, in companies having group insurance plans, individuals are eliminated through the use of physical examinations if they do not measure up to the standards set by the insurance company.

From this discussion of selection devices it is apparent that few if any unique procedures are used in the normal selection of individuals for employment in machine-accounting units.

Promotion.---The job classifications in numerous machine-accounting units at first appear to provide a natural promotional sequence from clerk to key-punch operator to machine operator and finally to supervisor. However, the statements of machine supervisors indicated that in most instances promotions occur only within job classifications rather than from one classification to another. The basic reason for this is the preference for men in machine operator positions, and women in key-punch operator positions. The

comments of the supervisors indicated that even in units that do promote frequently from within no set pattern of promotion has been established.

Salary.--Information concerning the specific salaries currently paid to individuals in the 42 machine-accounting units was available from only two units. In 27 of the 42 units, salary information was provided only in terms of starting salaries, top salaries, average salaries, or salary ranges for the positions in the specific units. Because of the diverse nature of the information gathered concerning salaries in the various positions in the machine accounting units, an extensive tabulated presentation here is impractical. It is the opinion of the author that Table 15 presents certain worthwhile information concerning salaries. This table indicates the lowest salary reported and the highest salary reported for each of the general job classifications in machine-accounting units.

TABLE 15

SALARY RANGES OF EMPLOYEES IN 42 MACHINE-
ACCOUNTING UNITS IN OKLAHOMA CITY

<u>Job Classification</u>	<u>Lowest Monthly Salary Reported</u>	<u>Highest Monthly Salary Reported</u>
Supervisor.	\$ 347	\$ 750
Chief Operator.	360	500
Machine Operator.	214	413
Key-Punch Operator.	185	325
Verifier Operator.	220	325
Card-a-Type Operator.	180	240
General Clerical.	153	327

It is recognized that in statistical practice it is not a sound idea to arrive at an average by using only high and low figures. However, in the analysis of accounting data this is an accepted practice. Therefore, the average, based on high and low salaries reported, is utilized here for comparative purposes. The only source available for comparison of salaries reported in this study with salaries reported from other sources was the annual salary survey for 1958, which was collected by members of the Oklahoma City chapter of the National Office Management Association and was pertinent to the local area.¹

The data for the Oklahoma City area was combined with that from other parts of the United States to provide comparative information for the entire country and each major city. Only Machine Operator and Key-Punch Operator salaries are included in the NOMA report. Thus, only two comparisons are pertinent here.

The average salary for Machine Operators in this study was interpolated to be approximately \$313 per month; the NOMA salary survey reports an average salary of \$272 for Oklahoma City and \$300 for the nation as a whole. These figures indicate that probably the actual salaries paid in the machine-accounting units in this study are slightly above

¹National Office Management Association, Office Salaries, A guide to 1958 Salary Rates prepared by the National Salary Survey Committee (Willow Grove, Pa.: National Office Management Association, 1957), p. 19.

average. The average salary for Key-Punch Operators was interpolated to be approximately \$255; the NOMA salary survey reports an average salary of \$222 for Oklahoma City and \$248 for the nation as a whole. This indicates that the actual salaries paid to Key-Punch operators in the 42 units also are probably above what might be expected.

Qualifications of Employees

The qualifications of employees as discussed here in terms of: personal traits, education, work experience, and in-service education, are based on stipulated company or agency policies, and opinions expressed by the supervisors of specific units.

Personal traits.--The purpose of obtaining information concerning personal traits was to attempt to isolate those qualities that appear to be most valuable to employees in machine-accounting units. It was assumed that the different types of jobs might require distinctive qualities.

In answer to inquiries concerning personal traits, all but six supervisors in the 42 machine-accounting units answered by indicating specific personal qualities that should be possessed by individuals in this type of work. Forty-four different descriptive terms were applied to the traits, abilities, and aptitudes that were considered essential. Statements by supervisors were closely scrutinized for what seemed to be specific classifications of personal qualities desirable

for people in the field of punched-card accounting. For the purpose of this study 12 traits, 8 abilities, and 2 aptitudes were isolated as indicative of the thinking of the supervisors. In Table 16 the 22 qualities that were considered desirable for employment in machine-accounting jobs are listed along with the number of responses pertaining to each quality.

TABLE 16

PERSONAL QUALITIES CONSIDERED BY 42 SUPERVISORS
TO BE DESIRABLE FOR EMPLOYMENT IN
MACHINE-ACCOUNTING UNITS

<u>Personal Qualities</u>	<u>Number of Responses</u>
Personal Traits:	
Adaptability	9
Emotional Stability.	7
Initiative	4
Dependability.	4
Physical Stamina	3
Conscientious.	3
Concentration.	3
Imagination.	2
Patience	1
Tact	1
Good Grooming.	1
Alertness.	1
Personal Abilities:	
Logical Thinking	15
Get Along With Other People.	15
Withstand Monotony	4
At Least Average Intelligence.	2
Firmness	2
Follow Directions.	2
Good Memory.	1
Mathematical Skill	1
Personal Aptitudes:	
Mechanical	14
Manual Dexterity	5

It should be noted that nearly all of the personal qualities listed in Table 16 are those generally accepted as desirable in any office employees. In several instances in the interviews what appeared to be controversial statements were made. From Table 16 it may be noted that 14 supervisors emphasized mechanical aptitude as a desirable quality for machine-accounting work. In several other instances, it was emphasized that there is no need at all for mechanical aptitude in its true sense because the machines are operated electrically. One supervisor specifically emphasized that "high-strung" individuals make good machine operators, which is the opposite of the idea that such traits as emotional stability and patience are required.

Based on the information presented concerning desirable personal qualities, the following generalizations appear to be significant: (1) the traits, abilities, and aptitudes required in workers in machine-accounting units are very similar to those required in other office occupations, the stress placed on certain specific qualities may be different; and (2) the most important traits that individuals should possess are ability to think logically, to get along with other people, and to adapt to new situations.

Education

Graduation from high school was indicated as the minimum educational requirement in 31 cases in this study;

10 supervisors indicated no minimum requirements whatever, and in one instance a college degree in accounting was required of all machine operators. In the 10 cases reporting no minimum educational requirements, seven did indicate that a highschool education is desirable for a person entering this field of accounting. In the 31 cases reporting highschool graduation as a minimum requirement, nine recommended that supervisory personnel possess college degrees; one of the nine extended this recommendation to include machine operators.

The opinions of the supervisors relative to specific subjects that should be included in the educational backgrounds of individuals preparing for entry into the field of employment varied extensively between machine units. The differences of opinion resulted from variations in the functions performed by the units and the experiences of the supervisors. Supervisors in 33 units expressed opinions concerning specific subject-matter needs in employment. A significant number reported study in the following subjects to be indicative of good formal preparation: (1) for supervisors, accounting and mathematics; (2) for machine operators, accounting and mathematics; and (3) for key-punch operators, typewriting. The degree of proficiency required in typewriting ranged from 30 words per minute to 50 words per minute in the instances where supervisors stated that typewriting was required for jobs. In nine machine-accounting units no specific subjects were listed as being especially valuable.

Another factor to be considered in educational background is specific machine preparation required of individuals in the field of automatic-data processing. In the 42 units involved in this investigation, 11 unit supervisors indicated that there is no special preparation required of any of the individuals seeking employment in their machine-accounting units. Six supervisors indicated that experience in the operation of punched-card machines is required in lieu of any specific instruction, two men indicated that on-the-job training provided all the instruction needed, and the remaining 23 unit supervisors indicated that one or more of the machine courses offered by the local IBM school fulfilled requirements for employment.

Some of the supervisors expressed specific opinions concerning the value of special machine preparation. In several instances, it was indicated that to be meaningful a special machine course would be preceded by experience in actual operation of punched-card equipment. In one instance, it was emphasized that only after three months of experience could a machine course be of value, and that after one year of experience the course would be of no value at all to an individual. In other instances, it was apparent that the basic philosophy of the utilization of machines was based on the fact that the machine is a tool for data processing and an understanding of the company and of general business information is more desirable than specific machine preparation.

In a few cases it was indicated that the equipment manufacturers' schools are absolutely essential to the preparation of individuals in certain job classifications.

From the foregoing material, it is apparent that the general requirements in Oklahoma City for employment in the field of machine accounting have not been established to a point that generally-accepted practice is evident. However, there is information on which to base the following generalizations: (1) high-school graduation is a minimum requirement, (2) accounting and mathematics often are required subjects in the educational backgrounds of supervisors and machine operators, (3) typewriting skill is frequently required of key-punch operators, and (4) special schools conducted by the machine manufacturers and distributors have been conducive to the preparation of machine-accounting personnel.

Work Experience

In 22 machine-accounting units it was specifically stated that no punched-card machine work experience is required for employment. One unit supervisor indicated that punched-card equipment experience is not important because all members of his machine-accounting unit come from within the company with on-the-job training backgrounds. In the remaining 19 units, varying degrees of work experience is required.

A significant number of interviewees emphasized that a person should have between three and five years of actual

work experience with machines prior to becoming a supervisor. In contrast, it was stated frequently that work experience requirements are waived completely for machine operators and key-punch operators in lieu of other factors in the records of applicants and the dire need for operators. Several supervisors indicated that it is difficult to adhere to strict work experience requirements in an employment area where there is a scarcity of good personnel. However, based on the reports of the 42 supervisors, it appears that one year of work experience is usually the minimum requirement for machine operators and six months is the minimum for key-punch operators. In several instances, it was indicated that the key-punch operator training offered by the local IBM school is sufficiently complete to be accepted in lieu of actual work experience.

The information here concerning work experience, when considered along with the educational requirements, indicates that persons having completed high school but not desiring to continue their formal education have opportunities for employment in the field of machine accounting in Oklahoma City. However, such opportunities exist at the lower job classifications and advancement may not be rapid.

In-Service Education

Formalized in-service education programs were described in only eight of the 42 machine-accounting units.

The eight supervisors indicated that types of on-the-job training made up their specific in-service education programs. In one instance, a 90-day program for key-punch operators and a 6-months program for machine operators are conducted by the supervisor on the specific machine or machines that each employee is to operate. In other units, rotation programs exist where each operator moves from one operation to another operation, or one machine to another machine, after he has achieved a high degree of skill on the job for which he was employed. Thus, each machine operator becomes capable of performing work on several different machines and can be shifted about as needs dictate.

In 34 machine-accounting units in-service training is accomplished only incidentally to normal operations. In some instances, individuals are sent to the local IBM school for instruction on certain punched-card machines, as need arises for such instruction. In other instances, the supervisors or senior employees instruct new employees in machine operations through operational direction rather than specific instruction.

Machine Utilization

Machine utilization is discussed here in terms of its effect on production, time and cost savings, and on accuracy.

Production

The production aspect of machine utilization in accounting relates directly to kinds of machines used in sequence to accomplish various types of work. The basic machines in a punched-card installation consist of the key-punch, verifier, sorter, and accounting machines. Other machines commonly found in machine installations include auxiliary machines such as the interpreter, collator, reproducer, and calculator. Each of these basic and auxiliary machines is described in Appendix A. In Table 17 is presented information relative to the kinds of punched-card machines used in Oklahoma City at the time this study was conducted.

TABLE 17

KINDS OF PUNCHED-CARD MACHINES USED IN 42 MACHINE-ACCOUNTING UNITS IN OKLAHOMA CITY

<u>Kinds of Machine</u>	<u>Number in Use</u>
Key-Punch.	141
Accounting	84
Sorter	74
Reproducer	68
Collator	56
Verifier	49
Interpreter.	33
Calculator	23
Typewriter-to-Card	7
Tape-to-Card Converter	6
Card-a-Type.	5
Typewriter-to-Tape	3
Card-to-Tape	2
Computer (Medium).	2
Multiplier	1
Statistical Sorter	1

Along with the punched-card equipment, each machine-accounting unit has use for office equipment such as typewriters, adding-listing machines, desk calculators, and other machines to perform specific functions in carrying out the total machine-accounting operation.

It should be noted that in 41 of the machine-accounting units at least one key-punch, one sorter, and one accounting machine were in operation. In the one remaining unit a card-a-type operation exists.

There does not seem to be any pattern in the number of auxiliary machines that are needed for each basic machine. To illustrate, in two cases five accounting machines are used. In one of these cases, five sorters, three collators, one interpreter, and three reproducers are used. Once basic installations are made, it appears that various business organizations make shifts and expansions in machine utilization to facilitate fulfilling any apparent need. Shifts and expansions, along with the obtaining of additional machines, are accomplished in diverse ways.

It was emphasized in most interviews that attempts are made continuously to operate basic machines as nearly full time as possible. However, within each unit operational time varies from machine to machine depending on the function of each machine in the total operation. Seldom are any machines used more than 75 per cent of available operational time. In some cases, machines with peculiar functions operate for 10 per cent or less of available time.

From this foregoing information, it is apparent that operation of the machines in a punched-card unit depends upon the specific applications performed by that unit and vary in terms of the volume of data handled in the operation and the number of functions performed with the data. Therefore, guides cannot readily be established to be used in measurement of the operational efficiency of a machine unit.

Time and Cost Savings

To the present time no comprehensive studies of time and cost factors in machine utilization have been made by any of the 42 companies involved in this study in Oklahoma City. However, in most of the case-study reports certain results are indicated which illustrate that definite savings in time, cost, or both have been realized.

In another section of this chapter it was indicated that, for all practical purposes, the total number of clerical and accounting employees has not changed to any appreciable extent because of the utilization of machine methods. With the same, or even greater, numbers of employees and the addition of machine rental or purchase costs, an over-all increase in actual work done by accounting units must be accomplished to justify punched-card equipment instead of the older manual methods. Increased volume of data processing has been experienced in most, if not all, of the 42 units involved in this study.

In all cases, except one, the punched-card machines in use are rented on monthly bases. The rate in each case is based on the number and type of machines in the unit. The rental amounts reported varied from a low of \$105 to a high of \$10,500 a month.

What appear to be significant savings of time were reported by almost all supervisors, but there have been no comprehensive studies to establish definite dollar amounts or per cents of those savings. The supervisors interviewed related specific instances of savings to their companies or agencies. Examples are presented here to illustrate the experiences of certain business concerns and governmental agencies in relation to time and cost savings.

In one instance it was reported that the time lag in preparing operating reports was reduced from 12 days to nine days through utilizing punched-card equipment. It is expected that through the installation of a small-scale computer these same reports can be made available in one-half day in the future.

Some supervisors reported time needs as minutes compared to hours or hours to days in illustrating the time savings through the use of machines. In one specific case it was reported that the weekly re-cap of sales was available within four hours when processed on the machines, whereas it had required a week when processed manually. In another unit it was found that manually a clerk could record accounts

receivable at the rate of 100 lines per hour, a punched-card machine now accomplishes the same task at the rate of 100 lines per minute.

In another case, it was stated that through the use of punched-card equipment it is possible to complete an extensive report in 11 hours on machines as compared to an estimated 55 man-years if completed manually.

Two slightly different points of view were related that should be specifically mentioned. In one case, it was stated that reports are made available in the same amount of time with machines as they were when manually prepared. The supervisor in this case further explained that any deadline may be met if the compiling of data starts soon enough. In this instance, more effective operations resulted from being able to move cut-off dates closer to the time for preparing reports. In effect, decisions are now reached quickly and more readily and the business functions more efficiently.

In another instance, it was indicated that the overall processing time is about the same but improved efficiency results from the ability of the machines to provide data which was not even contemplated previously because the time factor involved in manual preparation of the information was excessive. The additional data now available enables the company to save money through more efficient and rapid decision making.

In most instances in this study, the cost savings reported appear to be indirect savings. Actual costs of

operating the accounting units have not been reduced and in most cases have actually been increased. Economies and actual savings in companies do result from more complete data, volume increases with no added employment costs, added accounting functions with no added employment costs, and elimination of over-time because of speed in processing accounting data.

In several cases, specific cost savings were indicated for single operations. For example, a saving of \$900 was the result of completion of a special report costing \$300 on the machine compared to \$1,200 manually (two months work of a \$600-a-month employee). In another instance, in this same firm it was estimated that they were able to save \$1,000 per day, over a one-month period, in interest charges because of the rapid availability of information in statistical reports and operational reports presented in rate change cases. Another company reported that they are saving \$5,000 annually through improvements in the taking of physical inventories made possible through the use of a punched-card system.

In several instances, it was specifically reported that increases in over-all cost and in per-unit cost of specific operations accompanied the change-over to punched-card equipment. However, it was also indicated that the value of the increased data available for management's use more than offset the increased cost. In some instances, part of the increased cost comes about because of salaries paid for the higher-level skills possessed by machine-accounting people.

The Accuracy Factor

There were no records available to substantiate significant improvement in accuracy. However, statements concerning specific operations indicate that increased accuracy has meant definite savings for certain of the companies and agencies involved in Oklahoma City.

Because of the nature of the information concerning accuracy it is not readily tabulated. Therefore, a few examples of the experiences in the 42 machine-accounting units are presented. The nature of punched-card accounting is such that once data are punched into the tabulating cards and verified there is almost no chance for error because the human error element is eliminated. Many of the supervisors emphasized that errors in arithmetic calculations, extensions, transpositions, and omissions are eliminated once the machines "take over." One supervisor stated emphatically that in his unit the operation was 99.9 per cent accurate.

To illustrate further specific instances of the elimination of error and the increased accuracy in machine operations, the statements of six unit supervisors are quoted here without specific reference:

A decrease has resulted in the number of credit memorandums issued because of errors in pricing and extensions which are now caught in the machine operation.

Internal auditors more readily accept accounting information.

Time is now available in source departments to check documents for accuracy prior to machine processing.

A thorough check of invoices was made by a dealer for a six-month period and no errors were found in the invoices prepared on the punched-card machines.

A decided decrease in complaints regarding net pay calculations has been the result of the machine installation.

The machines are accurate to the penny. All differences between machine processing and the control records were traced to manual preparation of the source material.

It should also be noted that in two banking operations, where extreme accuracy is required regardless of the accounting methods used, it was noted that the accuracy of machines aids in balancing each day's business. Thus, definite savings are effected for both banking institutions.

Another specific instance of savings through accuracy was reported involving the discovery of \$1,200 in undercharges when machine operations were utilized for only a short period.

Analysis of the foregoing information might cause one to conclude that through the use of punched-card equipment all errors are eliminated. Actually, the most appropriate summation relative to the accuracy factor is that machine operations now result in only a few errors, whereas with manual operations in the past the errors were more numerous and often went undetected.

Unique Problems

In this chapter certain unique information has been presented from time to time in relation to the discussion of specific factors related to automatic accounting-data processing. Here some of the most unique problems directly related to punched-card machine operations are pointed up. In the interview situations, 30 supervisors commented on problems that in their opinions are unique to machine utilization.

One problem, prevalent in most machine units, involves personnel relations. Supervisor after supervisor, in the interviews, commented that the main problem encountered in changing from "pen-and-ink" methods to machine methods was the fear of loss of jobs by accounting and clerical personnel. In some instances this fear was partially overcome by providing employees with information about the change-over, through assuring certain individuals that, if they desired, they could transfer to other positions in the company, and through continually informing employees of the benefits to the company and to themselves from machine utilization.

Another significant and somewhat unique problem results from lack of adequate and uniform job classifications and descriptions. In several instances, it was found that individuals classified as machine operators had very little of the kind of experience necessary in the operation of various accounting and auxiliary machines. It was indicated that such individuals usually were hired with prior experience in

large installations where they had operated only one machine. For example, a person who had operated only a sorter, encountered considerable difficulty in adapting to a machine unit wherein he was expected to be competent in work associated with other machines. Experience limited to one machine is of very little value in most of the machine-accounting units in Oklahoma City, because they function with few employees but a variety of machines.

Another problem that relates to personnel and one that is frequently unique to governmental agencies, is that individuals gain experience with the agencies then tend to move on to better-paying jobs, or into small units as supervisors, with business organizations.

Space utilization and allocation is another problem experienced by most machine units. This is largely due to the fact that the units were not considered in the original planning of buildings and, therefore, the machine room tends to be located only in left-over space. The space is often overcrowded by the machines and operators have almost no room in which to maneuver. Seldom is space adequate for current operations and needed expansion is hampered. In one specific instance the supervisor indicated that after the plans were made for the original space utilization, the floor-space should have been doubled to adequately provide for present operations.

It should also be noted here that in 12 machine-accounting units the supervisors indicated that no problems existed that could be directly attributed to installation of the machines and that employees had welcomed the use of machines as they gained relief from the extreme clerical burden in the old manual methods.

Summary

In this chapter the data accumulated by means of the case-study technique have been analyzed in detail. Information based on the data was synthesized, tabulated when possible, analyzed, interpreted, and summarized so that findings are clearly revealed. To facilitate the presentation of the material accumulated concerning the 42 machine-accounting units in Oklahoma City this chapter was divided into major sections concerned with general information relative to the machine-accounting units; functions fulfilled by punched-card machines; and effects of machine utilization upon personnel and upon accounting factors of production, time, cost, and accuracy. Finally, in this chapter unique problems in accounting-machine operations were presented.

CHAPTER V

SUMMARY AND CONCLUSIONS

Re-Statement of Problem

This study has constituted an attempt to determine the nature and extent of the effect of automation on the bookkeeping and accounting phases of office work in Oklahoma City. Further, it has involved consideration of the implications for business education as the use of automated equipment is stabilized and educational needs identified more clearly.

The first step taken in this study involved an extensive review of published material in the field of automation to gain essential background data, information about automatic systems, and insights into automation from the points of view of businessmen and business educators. The second step involved the locating of business concerns using machine methods in their accounting departments. This was accomplished through interviews with representatives of the major distributors of punched-card equipment and an analysis of the membership roster of the Oklahoma City chapter of the National Machine Accountants Association.

The third step taken in this study was to develop an interview guide for the collection of data pertinent to the investigation and to maintain uniformity in the collection process. Several trial interviews were conducted in machine-accounting units to determine the availability of data and the adequacy of the instrument. From the information obtained in the trial interviews, case reports were written relative to the individual accounting units. Inadequacies in the interview guide disclosed in this trial procedure were corrected.

Step four in the procedure involved conducting extensive interviews with personnel in 42 accounting units. Following each interview, a comprehensive case study was written relative to procedures in the company or governmental agency involved. The data in the 42 case studies were then synthesized, summarized, interpreted, and consolidated into specific findings whenever possible. Comparisons with other studies and with significant presentations in the literature were drawn. The final step of this study involved preparation of this research report.

Findings Resulting From the Case Studies

As an outcome of utilization of the case-study procedure, considerable comprehensive information and data were accumulated. The information analyzed and interpreted into findings was based on specific elements in each of the 42 case studies.

General Information

Identifying information, along with other information not directly concerned with specific accounting functions, was gathered in an attempt to establish generalities concerning the use of punched-card equipment in the processing of accounting data. The utilization of punched-card equipment does not appear to follow any specific pattern with respect to the types of businesses using such equipment. The data indicate a concentration of installations in governmental agencies and three types of private business--wholesale distribution, insurance, and manufacturing concerns. It appears logical to assume that businesses utilizing punched-card equipment to advantage in Oklahoma City are probably the same kinds of businesses that would utilize punched-card machine methods extensively in other cities.

Specific business-volume figures are of very little value in determining the usefulness of machine methods. From the results of this investigation there appears to be no indication of need for or application of automatic methods in accounting based solely on dollar volume. Two generalizations, however, appear significant: (1) the very small businesses do not have their own installations of punched-card equipment, although, some do utilize the facilities offered by service bureaus, and (2) there is no significant relationship between business volume and utilization of punched-card systems of accounting-data processing.

The findings pertaining to numbers of employees in machine-accounting units in Oklahoma City indicate three significant generalizations: (1) comparisons of employees by types of work performed cannot be used as a basis for determining the effect of automation on employment in accounting positions, (2) fewer individuals are needed to perform the processing of accounting data by machine than by manual methods, and (3) there have been few if any reductions in the total number of employees in business concerns or governmental agencies as a result of the use of automated data-processing equipment. It appears that approximately three to four times the number employed to process accounting data by machine is a reasonable estimate of the number required to perform the same functions to the same degree by manual methods.

The findings of this study that are pertinent to organizational structure indicate that descriptive names used and the placing of authority for accounting varies according to the basic organizational pattern in each business concern or governmental agency. In general, however, machine-accounting units operate with authority, responsibilities, and details channeled through directors or managers, supervisors, machine operators, and general clerical workers.

Accounting Functions Fulfilled by Machines

Practice in the utilization of machines commonly involves starting with only one or two accounting functions

and having them fully stabilized before adding other functions. Billing, inventory control, and payroll appear to be the functions that most units prepare for application to machines at the time of original installations. The data in this study emphasize a basic characteristic of punched-card equipment utilization: capacity for expanding economically. As work-time of machines and personnel become available, the tendency is to add new functions to machine operations, thus increasing the efficiency of the total unit. The data make it apparent that the possibilities of machine utilization are almost endless. The findings indicate that improvement of data-processing, too, is a never-ending process. It should be noted that care must be taken in comparing various machine-accounting units and systems because it is obvious that the descriptive words used to indicate accounting functions differ even when actual functions are the same.

Two major purposes exist for the installation of punched-card equipment. The first of these reasons is reduction of unit costs in accounting units. The second purpose is to improve efficiency in the processing of accounting information. In general, reduced cost and improved efficiency are indicated in this study in terms of: (1) facilitation of increased business volume, (2) providing of information not available by manual methods, (3) reduction in personnel, and (4) simplification of the extensive clerical detail. The general effect on personnel, employed in the business

concerns and governmental agencies involved in this study, involved shifting of employment positions rather than reductions in numbers of clerical and accounting personnel. The data substantiate fully that normal employment attrition more than off-sets possible reductions in personnel. In some cases increased numbers of workers are required as machine methods enable businesses to expand their total operations.

The findings, relative to the effect of automation on the bookkeeping and accounting phases of office work parallel the ideas developed in the background section of this study wherein the impact of automation on accounting systems and procedures was analyzed from the viewpoints of businessmen and experts in the field of automation.

Personnel Factors

The 406 employees that constitute the personnel in the machine-accounting units involved in this study function under a variety of specific job designations. The data indicate that men are predominantly employed in the supervisory and machine operator positions, whereas women only are employed in key-punch operator positions. There appears to be no preference relative to sex in the other job classifications in machine-accounting units.

The information in this study indicates that in many cases standardized job descriptions for machine-unit positions would be of considerable value in the selection and placement of personnel.

The extent of education possessed by machine-accounting employees implies that at least a high-school education is basic for employment. However, other educational requirements are not readily apparent. It was also apparent that instruction in the operation of punched-card equipment is negligible at any level in the public educational system. The findings indicate that initial training on punched-card equipment is gained principally through on-the-job training and in equipment manufacturer's training schools.

Actual experience of the individuals employed in supervisory and machine operator positions indicates that, at the present time, there are no set patterns utilized in the employment and promotion of individuals in machine-accounting units. It appears that, because of the relative newness of this area of employment, varying and very flexible policies exist concerning work experience expected of personnel. Current employment practices, reflecting policies of business concerns and governmental agencies, indicate that there are no apparent deviations from normal employment practices applied to other office workers.

Data in this study, although not conclusive, indicate that salaries of individuals in machine-accounting work are somewhat above those of other office employees. The approximate monthly salaries in the general job classifications utilized in this study approximate: Supervisor, \$519; Chief Operator, \$430; Machine Operator, \$313; Key-Punch Operator,

\$255; Verifier Operator, \$273; Card-a-Type Operator, \$210; and General Clerical, \$240.

The personal traits, abilities, and aptitudes desired in machine personnel approximate those required of other office workers; stress on specific qualities is different. Specific traits that should be developed in individuals are ability to think logically, to get along well with people, and to adapt readily to new situations.

At present, few specific educational requirements have been formalized to the point that generally-accepted practice is evident. However, there are significant elements in that: (1) high school is the minimum educational requirement, (2) study of accounting and mathematics appears essential to supervisors and machine operators, (3) the development of typewriting skill is often required of key-punch operators, and (4) special schools conducted by machine manufacturers are of value to machine-accounting personnel. The factors relative to education requirements and experience, when combined make it apparent that the field of machine-accounting offers excellent employment possibilities for individuals who wish to terminate their formal education with high school graduation. In-service education is usually incidental to the over-all operation of machine-accounting units.

Machine Utilization

Concerning machine utilization, it appears that the numbers and types of machines, as well as operational time, in machine-accounting units depend to a large extent upon the specific applications in each unit, the volume of specific data handled, and the number of functions performed. Therefore, no established guides exist with which to measure operational efficiency of machine units in terms of actual machine and personnel utilization.

Even though no comprehensive studies have been compiled by the companies and agencies utilizing punched-card equipment, there is evidence that both direct and indirect savings result from machine usage. Direct savings experienced in the units considered in this study involved reduction, and in many cases, elimination of overtime. Indirect savings result as more information becomes available, increased accuracy is made possible, and units are expanded to handle auxiliary functions.

Through machine utilization, accuracy in accounting operations has been greatly improved. However, there are no extensive and conclusive studies to establish definite dollar amounts or percentage figures.

In any new undertaking by a business concern or governmental agency it is certain that problems will develop. The problems reported in this study relate primarily to personnel relations, lack of uniformity, and space utilization.

Implications for Business Education

The findings in this study in Oklahoma City do not facilitate, to the extent originally hoped for by the researcher, development of significant recommendations to be used in improving educational programs for the preparation of machine-accounting personnel. On the basis of the evidence here it appears that, in the near future at least, there will be numerous people who will graduate from high school and, through work experience or specific machine training, ultimately enter the field of machine accounting.

Business educators in secondary schools undoubtedly should endeavor to cause students to develop more problem-solving ability, logical-thinking ability, ability to get along with people when they work close together, and the ability to adapt to change. In addition students should perhaps be encouraged to study more mathematics, bookkeeping, and typewriting, all of which are fundamental to machine operations.

Since many colleges and universities utilize machine facilities in record keeping and student accounting, attempts should be made to integrate the use of present equipment in classroom instruction. An increased number of students should be encouraged to study accounting and machine accounting with a view toward entering the relatively remunerative supervisory and other occupations in machine units. In this connection, in numerous contacts with representatives of

machine manufacturing companies, the author was impressed with their desire to develop cooperatively educational facilities whereby additional numbers of persons might gain preparation for work in this field. To some extent this type of cooperation already exists in a limited number of private business schools and colleges.

Of perhaps greatest significance is the fact that business educators should engage in more intensive and extensive endeavors to understand what is currently being done and what the future implications are in machine accounting. The field is still relatively new, expansion is rapid, and the multi-billion-dollar business is certain to ultimately have a resounding impact upon education for business. Through additional studies, such as this one, much-needed data and information can be accumulated. It is the belief of this author that, as increased quantities of information are accumulated, more appropriate patterns of education for business can be developed.

Conclusions

The conclusions presented here are based on extensive library-type research and the data given subjectively by 42 supervisors of machine-accounting units in Oklahoma City. It may reasonably be assumed that similar machine-accounting units exist in similar types of business concerns and governmental agencies in other parts of the United States.

However, no claim is made that the findings and conclusions presented here are applicable to any circumstances other than those immediately involved. It is assumed that, in general terms the results of this study constitute valid evidence of the machine-accounting practices in business and industry.

On the basis of the relatively extensive findings in this study, the author concludes that:

1. Future expansion in the utilization of the relatively new automatic-data processing machines and techniques is assured because both large and small organizations can benefit from the greater efficiency, increased amounts of data, elimination of clerical routine, and the much more rapid preparation of accounting materials and reports.

3. General difficulties and specific problems in the installation of machine units, and later in expanding of stabilized functions of the units, necessitate the development of sources of material aid that can be utilized by management in establishing job classifications and employment requirements, training and re-training of employees, resolving personal reactions to the installation of machines, providing adequate physical circumstances, and the solving of numerous smaller problems unique to this phase of office work.

3. Personal traits, work-habits, and job preparation required by workers in the automatic-data processing

field are very similar to those required in other office workers, thus indicating that undoubtedly currently functioning educational facilities can be utilized in occupational preparation of prospective employees with only minor shifts in educational emphasis and a few relatively major adjustments concentrated chiefly around making machines available for instructional use.

4. Persons having responsibilities in education for business, at both the secondary-school and collegiate levels, should begin immediately to resolve the vocational education problems resulting from changes in the way routine clerical work is being accomplished and to more effectively recruit, prepare, and otherwise enable young people to gain initial employment and to advance appropriately in the satisfying and remunerative occupations connected with automatic-data processing.

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APPENDIX A

Selected Glossary of Machine Accounting Terms

ADP	Automatic Data Processing is an all-inclusive designation for automated systems of processing office information.
Accounting Machine	A machine that prepares the final printed report. A wired control panel is used to achieve flexibility in operation and control of this machine. This machine is sometimes called a "tabulator."
Calculator	This machine is the computing unit of a punched-card system. All the arithmetic processes may be performed on this machine. This machine is controlled by a wired control panel.
Collator	This machine performs the filing function of a punched-card system through the process of selecting, merging, matching, and sequence checking. This machine is controlled through a wired control panel.
Common Language	The principle required in automatic machines so that data may be transmitted from one machine to another in the processing sequence.
EAM	Electric Accounting Machine. This is the designation usually given to punched-card equipment.
EDP	Electronic Data Processing is the area of automatic systems where the data to be processed are handled through the use of equipment that stores and computes business information by means of electrical charges or magnetic marks. This equipment can handle a large quantity of data at electrical speeds. Because the machines used in EDP manipulate facts and figures by mathematical means, they are called "computers."

IDP	Integrated Data Processing is the area of automatic systems where all related data processing, by any method, is a harmonious and efficient whole.
Interpreter	A machine that translates the punched holes on the card for visual reading of the information punched into the card.
Key-Punch Machine	A machine that punches desired information, alphabetic or numeric into a card.
Punched-Card	A rectangular card 3 1/4 inches by 7 3/8 inches into which information to be processed by punched-card equipment is punched. There are 80 available punching columns in IBM cards and a maximum of 90 in Remington-Rand cards.
Reproducer	A machine that reproduces repetitive data automatically from a punched card or cards into other cards through the process of reproduction, gang-punching, mark-sensed punching, or summary punching. The control of this machine is through a wired control panel.
Sorter	A machine that will arrange punched-cards from a random order into a desired numeric or alphabetic sequence.
Verifier	A machine that is used to verify information through a re-keying or re-punching process.

APPENDIX B

Case-Study Reports

This appendix contains the case-study reports based on interviews with machine-accounting supervisors in 42 different business concerns and governmental agencies in Oklahoma City.

<u>Type of Business</u>	<u>Case Numbers</u>
Governmental Agency	1 - 5
Wholesale Distribution.	6 - 15
Manufacturing	16 - 21
Insurance	22 - 26
Petroleum Production and Distribution.	27 - 30
Public Utility.	31 - 33
Office Service Bureau	34 - 35
Common Carrier.	36 - 37
Banking	38 - 39
Theater	40
Publishing.	41
Oil Field Service	42

Governmental Agency

This case pertains to the operation of a governmental agency on the county level. The average number of employees in this agency is 60. Of this number, 15 are employed as appraisors and 45 are engaged in clerical and accounting jobs.

The organizational structure places responsibility for the operation of the unit with the County Assessor; a supervisor is in direct charge of the unit. The unit is called the "Machine-Accounting Department." The department has been in operation approximately 12 years. Machines were first installed to compile permanent records files for the assessment and tax rolls, and to fulfill the tax-billing function.

Of the 45 employees in clerical and accounting jobs, 12 are employed in the Machine-Accounting Department; one supervisor, one assistant supervisor, three machine operators, three key-punch operators, two verifier operators, one posting-machine operator, and one control clerk.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the 12 years the Machine-Accounting Department has been in operation, the number of employees has never exceeded twelve. In the opinion

of the supervisor, the 12 persons currently employed constitute an adequate staff for present operations. Four hours per day of overtime are required of the machine-accounting personnel during one month at the time tax bills are prepared. It was estimated by the supervisor that it would take many more than the number of employees in the assessor's office (60) to do manually what is done by machines.

Specific accounting functions.--The functions of this Machine-Accounting Department, at the time of installation, were tax billing and permanent record files for assessment and tax rolls. The functions have been expanded to include homestead exemption records, homestead receipts, and preparation of jury lists. These functions were added when it was determined that this work could be accomplished more rapidly and with less expense than by other means. When the Machine-Accounting Department took over these functions, additional personnel was required to handle the increased volume of work because of the steady increase in the population of the county. At the present time, no further additions to the functions performed by this machine unit are anticipated.

Machine accounting personnel.--The 12 employees that constitute the personnel of this department have specific job titles but no attempt has been made to formalize job descriptions. The Department Supervisor is a high-school graduate and has completed two years of college. She

received her initial training on punched-card equipment through on-the-job training with Douglas Aircraft on Remington-Rand equipment. This person has also attended the local IBM schools. Her total experience includes several years with Douglas Aircraft, one year in the general office, six years as the assistant supervisor, and two years in her present position.

The Assistant Supervisor is a high-school graduate and has completed some college work. He received his initial training on punched-card equipment in the local IBM school. His total experience includes two years as a machine operator in this unit and one year in his present position.

In the Machine Operator job classification, three individuals are employed, two men and one woman. All are high-school graduates. One of these three persons received his initial training through the intensified training program at Oklahoma State University. The other two received their initial training on-the-job with other governmental agencies. All three of these individuals had punched-card machine experience prior to employment with this agency. Two of the three have been employees for two years, the other for one year.

In the Key-Punch Operator job classification, three persons are employed. All are high-school graduates. Two of these three women received their initial training in

key-punch operations in the local IBM school, the other one through on-the-job training in another agency. All had experience as key-punch operators prior to employment in this agency. One of the three has been an employee of this agency for three years, one for two years, and the other for one month.

In the Verifier Operator job classification, two individuals are employed. Both are high-school graduates. One of these two women received her initial training on the job with this agency, the other in a local business college. One of the two had experience as a key-punch operator, the other transferred in from the general office at the time of installation of the punched-card equipment. Both were promoted from Key-Punch Operator classifications. One of the two has been an employee of this agency for more than 12 years, the other for six years.

The Control Clerk is a high-school graduate and had formal accounting training from a local business college. He is a long-service employee in the County Assessor's office with experience in appraising and other accounting functions. The control clerk in this operation is also an intermediary for the punched-card unit and the regular accounting department. He has been in his present position for five years.

The Posting Clerk is a high-school graduate and has completed several hours of college work. She is not

experienced on punched-card equipment because her position is that of manual posting of items not to be processed by the automated system. Her experience includes three years in a general clerical position and six years in her present position.

Current employment practices.--Sources of personnel:

New employees are hired for office jobs at the level in which there is an immediate need. The sources of personnel for this department are the local IBM office, other supervisors, and the local Machine Accountants Association.

Selection devices: All persons who seek employment with this office are required to fill out an application blank containing general information. Upon completion of the application blank, an interview is conducted by the supervisor of this machine-accounting unit who also makes decisions to hire. In this Machine-Accounting Department, the IBM aptitude tests are used. The applicants are sent to the local IBM office for testing. References from previous employment and of character are asked for and a thorough check is made of all references listed. No physical examination is required. However, it was indicated that a person should be in good physical condition because of the excessive amount of lifting required.

Promotion and salaries: Promotion is generally from within and an individual is up-graded whenever possible as

vacancies occur. It has been the practice of this office to promote individuals from within into supervisory positions; the sequence is from Machine Operator to Assistant Supervisor to Supervisor. The specific salaries for the 12 jobs in the machine-accounting department are as follows: Supervisor \$525; Assistant Supervisor \$425; Machine Operators \$350, \$325, and \$275; Key-Punch Operators \$250 and \$215; Verifier Operators \$300 and \$275; Control Clerk \$525; and Posting Clerk \$250.

Qualifications of employees.--Personal traits: The personal trait emphasized for personnel in this department was the ability to get along with people.

Education: A high-school education is required for employment in the Machine-Accounting Department of this county agency. Typewriting ability is a necessity for the key-punch operators with training in accounting recommended for machine operators. Special machine preparation should include as many schools as possible for machine operators and the key-punch school for key-punch operators. It was indicated that operators are expected to be more than just "button pushers."

Experience: Experience on equipment is required for employment. In this department, attempts are made to insure that both key-punch operators and machine operators have at least two years of experience prior to employment. In this

specific installation, the supervisor and control clerk should have had some experience in real estate and be able to read legal descriptions.

In-service education: This county office has no planned in-service education program. When possible employees are sent to the local office of IBM for special instruction.

Machine utilization.--Production: The machines in use and the percentages of time in operation where known are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (3)	88
Verifier (2)	88
Sorter (2)	30
Collator (4)	80
Accounting (3)	80
Reproducer (2)	60
Interpreter.	60
Calculator	--
Adding Listing (3)	--
Desk Calculator.	--
Typewriter	--

The IBM machines are rented for a monthly fee of \$3,379.

Time and cost savings: A significant saving of time was reported but there have been no studies to establish definite dollar amounts or percentage of savings.

Accuracy factor: There were no records to indicate whether there was any significant improvement in accuracy. However, based on statements of the supervisor, it is assumed that increased accuracy has resulted in definite savings.

Case No. 1

Unique problems.--The supervisor stated that the main problem encountered in this machine-accounting unit was that of personnel turnover. He indicated that many times this unit has been used by individuals to gain qualifications for supervisory positions in smaller installations.

Case No. 2

Governmental Agency

This case pertains to the operations of a department of the public education system. The public education system includes 91 schools: three senior high schools, five junior high schools, eight junior-senior high schools, and 75 elementary schools. The approximate total enrollment is 60,000 students.

The average number of employees of this education system is 4,000. Of this number, 1,900 are employed as teachers, 18 are engaged in the research and statistics department, and the remaining 2,082 employees are engaged in the administrative and maintenance phases of the total operation.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Assistant Superintendent of Research and Statistics; a supervisor is in direct charge of the unit. The unit is called the IBM Section of the Research and Statistics Department. The present machine-accounting section has been in operation

approximately eight years. Machines were first installed to fulfill school-census and pupil-accounting functions. Of the 18 employees in the Research and Statistics Department, five are employed in the IBM Section; one supervisor, one machine operator, two key-punch operators, and one verifier operator.

Machine Accounting Operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. The use of machines in this case has been hampered because of a lack of coordination between departments utilizing the equipment. In the eight years the IBM Section has been in operation, the number of employees has never exceeded five. In the opinion of the supervisor, five persons currently employed constitute an adequate staff for present operations except for the month the school census is completed and at the end of each school year when year-end attendance reports are prepared. At these times, extra key-punch operators are hired on a part-time basis. These persons are ex-key-punch operators. No estimate was made by the supervisor concerning the number of individuals that would be required to do manually what is now done by machine. He believed the conflicts existing tend to distort the accounting personnel needs.

In this school system, year-end reports are due on July 1, following the closing of the Spring semester. It is

the consensus of personnel in this unit that this would be a monumental task if the accounting machines were not available. It was related that only one night of overtime has been required during the past seven months. This period included preparation of year-end reports. The elimination of overtime was attributed to better scheduling of machine time. Prior to this time, even with the machines, excessive overtime was experienced.

Specific accounting functions.--The functions of this machine-accounting division at the time of installation were school census and pupil accounting. The functions have been expanded to include financial accounting and text-book accounting. The financial accounting became an added function when it was determined that this work could be accomplished along with the original jobs of the unit. At the time the IBM Division took over this function, it was being done by the local service bureau and no reduction in personnel was experienced. Text-book accounting became a function of the IBM Section when it became apparent that the extensive clerical burden in the manual preparation of appropriation and expenditure records for each school in the system, could be drastically reduced with the machines available.

At the present time, procedures for student registration are being readied for use, in the secondary schools, starting in the fall of 1959. This is to relieve the clerical

burden presently required of teachers. Class schedules and class records of students will be prepared through use of punched cards and punched-card procedures. It is also anticipated that inventory control will be added to the functions of this unit, after the storerooms are reorganized. In adding inventory control, no change in personnel is anticipated; under the present system no records are kept of receipts and issuance of materials or supplies from the storerooms.

Machine accounting personnel.--The five employees that constitute the personnel of this unit have specific job titles, although no attempt has been made to formalize job descriptions.

The Section Supervisor is a high-school graduate with two years of graduate study; his undergraduate degree was in English. His knowledge of punched-card equipment was obtained through on-the-job training with the Oklahoma City Air Material Center. His total experience includes one and one-half years as a machine operator and five and one-half years as a lead operator with the OCAMC, three years as a lead operator in a public utility company in another state, and one year in his present position.

The Machine Operator is a high-school graduate and lacks only 15 hours for the completion of a college degree. His source of initial training was on-the-job training while

employed with a business concern. He has also attended the basic-machine operators class conducted by the local IBM office. His total experience includes one year as a machine operator prior to his present employment and one year in his present position.

In the Key-Punch Operator job classification two individuals are employed. Both are high-school graduates and both received their initial training in key-punch operations in the local IBM school. Both of these women had experience as key-punch operators prior to employment; one had one year, the other six months. One of the two had been an employee of this agency for two years, and the other for one year.

The Verifier Operator is a high-school graduate and received her initial training as a key-punch operator through the local IBM school. This person had three years experience as a key-punch operator in other states, one year as a key-punch operator with this education system and has been in her present position for one month.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need, after possibilities of promotion have been completed. The source of personnel for this section is the local IBM office.

Selection Devices: Persons who seek employment with this city agency are not required to fill out an application blank; however, an application blank containing general information is used by the supervisor of this unit. An interview is conducted by the supervisor of this section. The final selection of an individual is contingent upon the approval of the Assistant Superintendent of Research and Statistics. The IBM aptitude tests are used. The applicants are tested by the supervisor. References from previous employment are asked for but are not considered in the selection procedure. It is the opinion of this supervisor that references are of very little value. No physical examination is given. The selection procedure usually followed for employment in accounting and clerical positions is through the personnel office. However, for machine-accounting personnel the individuals are processed by the supervisor and then the proper employment records are completed in the personnel department.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when vacancies occur. It was related that the only promotions were from key-punch operator to verifier operator. It was the opinion of the supervisor that there is not enough relationship between key-punching and machine operating to warrant promotion from key-punch operator to machine operator. The specific salaries for the five jobs in the IBM Section are

as follows: Supervisor \$500, Machine Operator \$300, Key-Punch Operator \$225 and \$210, and Verifier Operator \$225.

It is the policy of this system to start supervisors at \$500 a month and raise them on a yearly basis the same as school principals. The normal increment is \$200. Machine Operators are hired at \$300 a month and are raised the same as the supervisor. Key-punch Operators are hired at a base wage of \$200 plus \$5 for each year of experience. These individuals are given a \$5 a month raise every six months. No maximum salaries were indicated by the supervisor. The salaries reported for this machine-accounting unit indicate that the actual salaries paid are above average for machine operators and average for key-punch operators as compared with salaries revealed by the National Office Management Association salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized for the supervisor and machine operator were mechanical aptitude, statistical aptitude, and ability to think logically. Those emphasized for key-punch and verifier operators were the ability to get along with people, good work habits, and tact. Tact is especially desirable in verifier operators because of the necessity of pointing out and explaining errors in key-punching.

Education: A high-school education is required for employment in this IBM Section. It is desirable for the

supervisor to have a college degree but not a necessity. An accounting and mathematics background is of extreme value to a supervisor and is recommended for machine operators. Typewriting ability is a necessity for key-punch and verifier operators with emphasis on accuracy. It was related that if a key-punch operator is not accurate it is impossible for him to be promoted to the position of verifier operator. No special machine preparation is required of machine operators; however, key-punch school was considered a necessity for key-punch operators. It was the opinion of the supervisor that the courses offered for machine operators are of value only if it is possible for an individual to attend them after three months of actual experience on the job; after one year's experience, the schools are of no value.

Experience: Experience on equipment is required for employment. Attempts are made to insure that supervisors have at least three years' experience, machine operators have at least one year of experience, and for key-punch operators an experience requirement is waived in favor of key-punch operators school.

In-service education: An in-service education program for both machine operators and key-punch operators is conducted by the supervisor. Personal instruction is given to machine operators covering machine operations and procedures studies. Key-punch operators are instructed in

procedures only. Also when possible a machine operator is sent to the local IBM school for specialized training on a specific machine.

Machine utilization.--Production: The machines in use and the percentages of time in operation where known are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (3)	--
Verifier.	--
Sorter.	70
Collator.	50
Accounting.	75
Reproducer.	50
Interpreter	40
Adding Listing.	--
Typewriter.	--

Machine utilization is in the process of study to provide a basis for improvement of present production. Machine rental is budgeted at \$14,000 a year. The machine rental on a monthly basis would be approximately \$1,166.

Time and cost savings: A significant saving of time was indicated in statements from the supervisor. However, there has been no study to establish definite dollar amounts or percentage figures. It was emphasized that it would be difficult to prove any "dollar and cents" savings.

Accuracy factor: There were no records kept to indicate whether there has been a significant improvement in accuracy. However, based on the statements that follow, it

is assumed that increased accuracy has resulted. "Since the machine installation was effected, financial accounting has been accurate to the penny. Any difference between the machine process and a manually prepared control figure has been traced to manual procedures. The school census is as accurate as the information presented in source documents; however, it is impossible to determine the actual accuracy of the census compared to manual methods." To illustrate definite time savings, the supervisor related that books are now closed by the seventh of each month whereas under manual methods it was considered exceptional if the books were closed by the twentieth of the month. It was also indicated that the speed and accuracy attainable in machine methods were considered more important than money savings.

Unique problems.--The supervisor indicated that the main problem encountered in changing from "pen-and-ink" methods to machine methods was the lack of coordination between departments. This reverts back to fear of loss of jobs by accounting and clerical personnel. This is being overcome by educating individuals to the fact that the machines will relieve them of tedious monotony of repetitive clerical tasks, giving them more time to perform the phases of each job that require human decisions.

Governmental Agency

This case pertains to the operations of the machine unit of a state agency. This agency's primary function is the training of doctors and nurses in a state school of medicine. Along with this primary function, a general hospital is operated. The machine-accounting unit is a part of the hospital operation. There are 469 beds available for patients. An average of approximately 11,500 bed patients are treated each year along with approximately 100,000 outpatients. The income for this agency comes from legislative appropriation with little or no income from patients, who are mainly state aid cases. The average number of employees of the agency is 1,500. Of this number, 500 are engaged in clerical and accounting jobs, and the remaining 1,000 employees includes the medical school staff, nurses, aides, maintenance personnel, orderlies, and dietitians.

The organizational structure places responsibility for the operation of the machine-accounting unit with the business administrator of the hospital who in turn is responsible to the Dean of the Medical School; a supervisor is in direct charge of the unit. The unit is called "Machine Records and Medical Statistics." This unit has been in operation approximately seven years. Machines were first installed to fulfill accounting and medical statistics functions.

Of the 500 employees in clerical and accounting jobs five are employed in the machine-accounting unit; one supervisor, one machine operator, one verifier operator and two key-punch operators.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the seven years this unit has been in operation, the number of employees has never exceeded five. In the opinion of the supervisor, the five persons currently employed constitute an adequate staff for present operations. Because of a much larger volume of data to be processed and an increase in the number of reports that were not available manually, no estimate regarding the number of additional persons that would be required to do manually what is currently done by machines was ventured by the supervisor.

In this hospital, closing the books and preparation of financial reports must be accomplished at the end of each month and at the end of the year. It is the consensus of personnel in this unit that this along with the regular daily operations would be a monumental task if the accounting machines were not available. The utilization of machines has eliminated all overtime in this accounting operation. The

elimination of overtime was emphasized by comparing manual and machine methods in preparation of the payroll. It took ten days, with overtime, to process manually a payroll of 600. With punched-card equipment, no overtime is required in processing a payroll of 1,500 employees in only two days.

Specific accounting functions.--The function at the time of installation was largely that of compiling medical statistics. The functions have been expanded to currently include: stores inventory, preparation of the payroll, accounting for requisitions, and preparation of purchase orders. These functions were added when it was determined that the work could be accomplished more rapidly and with less expense than by other means. At the time the machine-accounting unit took over these functions, all employees whose jobs were eliminated were transferred to other departments within the hospital. Extensive clerical burden in a manual operation is used as the basis for determining the functions to be added to machine processing. At the present time, no changes of functions in the machine-accounting unit are anticipated.

Machine accounting personnel.--Job descriptions:

For the present organization of Machine Records and Medical Statistics, the following job descriptions established by the Oklahoma State Employment Securities Commission are used:

Supervisor, Tabulating: Sets up and supervises record-keeping by punch cards and special office machines.

Plans and designs operations: Meets with department heads to plan a record-keeping operation. Plans and designs operations to meet the requirements of the department.

Sets up machines: Wires plug boards to produce the desired result.

Supervises, instructs, and trains employees in the Tabulating Department in proper methods and procedures to carry out the functions of the department.

Directs care and cleaning of the machines, may make mechanical adjustments and minor repairs in emergencies.

Recommends personnel actions regarding changes of status of all employees under his supervision. Hires and discharges employees in the department.

Details of physical activities: Lifts and carries plug boards weighing up to 20 pounds. Pushes and pulls plugs requiring great finger dexterity and eye-hand coordination, but small amount of physical strength. Lifts and carries boxes of new cards weighing up to 60 pounds. Works under conditions of frequent interruption.

Tabulating Operator: Operates Tabulating Machine which automatically translates information or data from punched cards into printed information on form sheets, cards, or accounting records.

Operates tabulator machine: Places proper plug-board into machine according to written or verbal directions from the supervisor. Places punched cards into feed magazine, and places stacks of printed forms into carriage of the machine. Starts machine by pressing starter button. Makes adjustments to the carriage, and fans cards to eliminate static electricity, or makes minor adjustments to assure proper operation.

Operates card-sorting machine: Sorts cards into proper sequence for other operations by using an automatic card-sorting machine.

Operates collator machine which automatically checks sequences of sorted card groups and matches detail cards against master cards.

Receives written or verbal information from Personnel Department or other sources which require changes in the payroll. Pulls proper card from

payroll file, enters written instructions on card and routes it to Key-Punch Operator for purposes of making a corrected card.

May operate Key Punch and Verifier Machines.

Details of physical activities: Lifts, carries, and places plug-boards weighing up to 20 pounds in the machine. Lifts and carries boxes of cards weighing up to 12 pounds.

Key-Punch Operator: Records data on tabulating cards by punching holes in the cards according to a specified sequence, using a punch machine; checks and verifies the accuracy of the data punched on the tabulating cards, using a Verifying Machine.

Operates Key-Punch Machine to make tabulating cards: Places blank cards on carriage of the machine or into automatic feeder device, and positions carriage for perforating operation. Punches number, letter, or symbol keys on the machine keyboard to transcribe written information or data into perforations or printing on the tabulating card.

Operates Verifier Machine to verify correctness of punched cards: Places punched cards to be checked into machine carriage. Punches keys on keyboard to correspond with written information or data which was used to make the tabulating card. Presses key to start machine, which automatically checks the correctness of the punched cards, stops when an error is located. Removes the card which is in error, and makes the proper correction or makes new card on the Key-Punch Machine. Removes verified cards from receptacle.

Details of physical activities: Sits for long periods at machine and operates keyboard requiring a great amount of finger dexterity. May lift and carry boxes weighing up to 15 pounds.

These job descriptions depict essentially the same general duties as the descriptions developed by the National Office Management Association.

A summary of the qualifications and experience of the employees is provided in the following paragraphs.

The Supervisor is a high-school graduate and has completed one year of college. He received his initial

training on punched-card equipment on the job with this agency and through the local IBM schools. His total experience includes four years as a storekeeper in the hospital, two years as a machine operator, and five years in his present position.

The Machine Operator is a high-school graduate and received his initial training on punched-card equipment through another state agency. His total experience includes ten years with the Oklahoma Tax Commission and one and one-half years in his present position.

In the Key-Punch Operator job classification, two individuals are employed. Both of these women are high-school graduates and received their initial key-punch training from the local IBM school. One had six months of experience as a key-punch operator prior to her employment. One of the two has been in the employ of this state agency for two years, the other for one year.

The Verifier Operator is a high-school graduate and received her initial key-punch training through the local IBM school. Her total experience includes five years as a key-punch operator in a private business concern and two years in her present position.

Current employment practices.--Sources of personnel:
New employees are hired for office jobs at the job level in which there is a need. The sources of personnel for this

unit are the local IBM office and personal contacts with other supervisors of machine-accounting units.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. Upon completion of the application blank, screening interviews are conducted by a personnel clerk. The final selection of an individual is contingent upon the approval of the supervisor. No testing program is conducted as a part of the selection procedure. References from previous employment and of character, are reviewed for each individual seeking employment. An extensive physical examination is given. General good health is required of all employees.

Promotion and Salaries: Promotion is primarily from within and an individual is up-graded if possible when vacancies occur. Specific salaries for the five individuals in the unit were: Supervisor \$400, Machine Operator \$340, Key-Punch Operator \$195, \$185, and Verifier Operator \$220. The salaries reported for this unit indicate that the salaries paid are above average for machine operators and below average for key-punch operators, as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Education: A high-school education is required for employment in the machine-accounting unit of this hospital. Typewriting ability is a

necessity for the key-punch operators. A course in basic accounting is a necessity for machine supervisors. Special machine preparation is required for supervisors and machine operators.

Experience: Experience on equipment is required for employment in the supervisor's position. IBM courses are considered as experience requirements for machine operators.

In-service education: No planned in-service education program is in operation in this agency. A specific period is set for job training in each position: Supervisor 2 months, Machine Operator 4 months, and Key-Punch Operator 6 months. If an occasion arises, personnel are sent to the local IBM school for special machine training.

Machine utilization.--Production: The machines in use and the percentages of time in operation, when known, are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (2)	80
Verifier.	80
Sorter.	44
Collator.	31
Accounting.	55
Reproducer.	42
Interpreter	16
Calculator.	10
Adding Listing.	--
Desk Calculator	--
Typewriter.	--

The IBM machines are rented for a monthly fee of \$1,000.

Time and cost savings: A significant saving of time was indicated in a statement from the unit supervisor. However, there has been no study to establish definite dollar amounts or percentage figures. The eight days saved on the payroll application previously described, is an indication of savings of time possible through machine utilization.

Accuracy factor: There were no records kept to indicate whether there has been a significant improvement in accuracy. However, through verification and machine check, accuracy is assured to a high degree. Once the information is accurately punched into a card, there is little chance for human error since any further processing is performed by machines.

Unique problems.--The supervisor indicated that the main problem encountered in changing from "pen-and-ink" methods to machine methods was the fear of loss of jobs by accounting and clerical personnel. Along with this fear, there was a lack of understanding of machines, and a disbelief in speeds of operation and use of cards for processing information. This was overcome by instruction to the employees concerning the phases of machine use in relation to their specific jobs.

Governmental Agency

This case pertains to the operation of a federal governmental agency center. The center, established in 1946, was moved to Oklahoma City from Houston, Texas. Through the efforts of several interested individuals in Oklahoma City, this center has been enticed to expand to the present centralized operation. This center was originally established to conduct specialized standard training, along with the centralized warehousing and supply service. The students that attend the standardized training program come from many foreign countries as well as the individuals employed by the United States Government. The central supply unit is a consolidation of all supplies, for supply support, of the agency throughout the United States. Thirty-five thousand items are carried including electronic, maintenance, and navigational equipment and supplies. The average number of employees is 1,200. This number includes administration, instruction, and clerical and accounting personnel.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Chief of Stock Control Branch, who in turn is responsible to a Division Chief on the Director's Staff. A Section Chief is in direct charge of the unit. The unit is called the "Tabulating Equipment Planning and Operations Section." The section has been in operation one year. Machines were first

installed to fulfill the inventory-control function. The first five months of operations was used for testing and programming the functions that were to be performed. Nine individuals are employed in the section: one section chief, one operations supervisor, one working supervisor, and six tabulating-equipment operators. The latter individuals operate both key-punch machines, accounting machines, and auxiliary equipment.

Machine accounting operation.--There has been no variation in the number of employees engaged in clerical and accounting jobs throughout this agency office due to the use of machines. However, since this is a consolidation of warehouse activities, individuals located in four other geographical areas, whose jobs were eliminated, were all given a chance to transfer to the Oklahoma City office into a position for which they were qualified. In the one year the division has been in operation, the number of employees has increased from six to nine. In the opinion of the supervisor, the nine persons currently employed constitute an adequate staff for present operations. It was pointed out by the supervisor that because of the relatively short length of time the unit has been in operation, the number of additional persons that would be required to do manually what is currently done by machines, could not be estimated. It was also emphasized that many items processed would be impossible

manually. Because of the nature of this unit, there are no peak load periods; at this time, no reports have to be prepared by a certain date. No overtime is expected in the operation of this unit. By thorough planning, all data processing is scheduled to be completed during the regular work period.

Specific accounting functions.--The function of this section, at the time of installation of punched-card machines, was that of inventory control. No additions have been made to the initial operation. As previously mentioned, this machine unit was established when four regional warehouses were consolidated. This consolidation did not take place to replace manual procedures with machine procedures. The utilization of machines was incidental. Prior to consolidation, inventory was kept on Kardex files.

At the present time it is anticipated that aircraft control will be added to the functions. In adding aircraft control, it is thought that no one will be eliminated from employment. Any person whose job might be eliminated will be re-located in other jobs under civil service, according to their qualifications. This anticipated change will fit naturally into the present inventory-control function.

Machine accounting personnel.--The nine employees that constitute the personnel of this section have specific job titles and extensive job descriptions. These job

descriptions were in the process of revision and were not available.

The Chief of Stock Control Branch is a high-school graduate and received his initial punched-card equipment training in the United States Army. His total experience includes eight years in a machine-accounting unit of the Veterans Administration and one year in his present position.

The Operating Supervisor is a high-school graduate and received his initial training on punched-card equipment through on-the-job training while employed at Tinker Field. His total experience includes six years at Tinker Field as a machine operator, and four months in his present position.

The Working Supervisor is a high-school graduate and received his initial training on punched-card equipment through on-the-job training while employed at Tinker Field. His total experience includes two years at Tinker Field, five months as a machine operator with this agency, and one month in his present position.

In the Tabulating-Equipment Operator job classification there are six individuals employed, three men and three women. These individuals are all high-school graduates and received their initial training on punched-card equipment through on-the-job training while employed at Tinker Field. Their total experience varies but was made up of service with the federal government in the Tinker Field installation.

Their time in service in this installation ranges from four months to one year. In this installation the individuals classified as Tabulating Equipment Operators are combination key-punch, accounting, and auxiliary machine operators.

Current employment practices.--Sources of personnel:

New employees are hired for office jobs at the job level in which there is an immediate need. The source of personnel for this division is the Civil Service Register.

Selection devices: All persons who seek employment are required to fill out an application blank containing general information. An interview is then conducted by a personnel clerk. The final selection of an individual for this unit is contingent upon the approval of the unit chief and operating supervisor. As in all civil-service positions, the individuals must have taken the Civil Service Qualifying Examination to obtain status. References from previous employment and of character are checked in the selection procedure for each individual seeking employment. An extensive physical examination is required upon entrance into civil service positions.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded, if possible, when vacancies occur that call for service ratings for which the individual is qualified. Information concerning the specific salaries for the nine jobs in the unit was not available.

The Section Chief did indicate the range of salaries was from \$3,200 a year in the lowest paid job, Tabulating Equipment Operator, to \$6,800 for the chief of the unit. The range in salaries reported for this unit indicates that probably the actual salaries paid are above average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal trait emphasized for personnel of this unit is the ability to get along with people. It was indicated that individuals in the supervisory positions should possess the ability to think analytically.

Education: A high-school education is required for employment. Mathematics, science, and accounting courses were indicated as being helpful to any employee in a machine-accounting unit.

Experience: Experience requirements are contingent upon the government service ranking that each job carries.

In-service education: There is no planned in-service education program; however, training for specific procedures and machine operations is conducted through on-the-job training.

Machine utilization.--Production: The machines in use are as follows: two card punches, two verifiers, one sorter, one collator, one accounting, two reproducers, one interpreter, one calculator, and one adding listing. Records

Case No. 4

that would show per cent of operational time for punched-card machines have been sacrificed in getting the primary function of data processing established. At the time the case interview was conducted, a machine utilization record was in the process of development. The IBM machines are rented for a monthly fee of approximately \$2,000.

Time and cost savings: A significant saving of time and cost may be assumed from the fact that this unit is a consolidation of four separate units. However, there has been no study to establish definite dollar amounts or percentage figures.

Accuracy factor: There were no records kept to indicate whether there has been a significant improvement in accuracy at this stage of machine utilization in this agency.

Unique problems.--The chief of this unit indicated that there were no unique problems encountered in changing from "pen-and-ink" methods to machine methods because of the extensive utilization of machines by the Federal Government in other agencies.

Case No. 5

Governmental Agency

This case pertains to the operations of a governmental unit at the city level. A city manager-council form of government is the administrative body for this city. The estimated population, January 1, 1958, was 425,000. This

unit performs the accounting function for the city utilities billing service for water and garbage. The consumption of water for the first six months of 1958 was 4,669,438,000 gallons.

The organizational structure places responsibility for the operation of the unit with the city manager, a superintendent being in direct charge. The unit is called "Machine-Billing and Accounting." The present machine accounting unit has been in operation for approximately three years. Machines were first installed to fulfill the utilities billing function. Of the employees in clerical and accounting jobs within the city offices, nine are employed in the machine-accounting unit; one superintendent, one machine supervisor, two machine operators, and five key-punch operators.

Machine accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the three years the machine-accounting unit has been in operation, the number of employees has never exceeded nine. In the opinion of the supervisor, the nine persons currently employed constitute an adequate staff for present operations. No estimate was made by the supervisor

regarding the number of additional persons that would be required to do manually what is currently done by machine. He emphasized that because of a greatly increased amount of work accomplished, it would require a manual operation that would be impractical.

The utilization of machines has completely eliminated any peak load requirements, and no overtime is required to perform the total operation of this unit. It is the consensus of personnel that this total operation would be a monumental task if the machines were not available. Through the use of punched-card methods, the local city management now receives reports of value that were not even envisioned when manual "pen-and-ink" methods were in use.

Specific accounting functions.--The function of this unit at the time of installation was that of utilities billing for water service. The functions have been expanded to include: additional utilities billing (garbage), cash posting, preparation of paving receipts, and a route listing to be used by drivers in the collection of garbage. As the machine unit took over these functions, it was possible to transfer four billing clerks and eight cash posting clerks to other departments within this agency. At the present time, the supervisor does not anticipate any new functions being added to the operation of this unit.

Machine-accounting personnel.--Job descriptions: The nine employees that constitute the personnel of this unit have specific job titles. Complete job descriptions are prepared for the following positions: Machine Supervisor, Machine Operator III (accounting machines), and Machine Operator I (key-punch operator). These complete job descriptions are:

Machine Supervisor.--Personnel: It is the duty of the Machine Supervisor to direct all personnel operations for the Department, such as, assignment of duties to all employees, and to have complete knowledge of the capabilities of each employee and to use this to the best advantage of the department. The Machine Supervisor has control over leave of absences and must process these through the Department head for approval. He must have complete knowledge of all personnel procedures to be followed.

Processing: He has direct responsibility for the work processing for the department. He must schedule the work from the various departments concerned and and schedule machine time in order to complete the processing on a time schedule. He must assume direct responsibility on all priority processing.

Technical: The Machine Supervisor has direct responsibility for the technical phase of our operation. He must make periodic checks to insure the accuracy of the machine functions. He gives assistance to the Machine Operators only on a technical nature. His knowledge of wiring functions is essential and must be able to determine the processing steps to be taken relative to panel wiring in order to obtain the required results. In case of machine trouble (break-down) he must assist the repair technician in determining the trouble so only a minimum loss of time exists.

Analyzing: Assists the Machine Operators on all account transactions that are unusual. Checks all reports for accuracy of sequence as well as report totals.

Planning: The Machine Supervisor must assist the Department Head in all planning of expansion of present operations or completely new jobs. Analyzing of machine time, procedures, and personnel to be used is essential. He must have a knowledge of the needs

for certain reports and be able to suggest to the Department Head savings or advantages in processing procedures. He is responsible for figuring processing steps in the machine room which might save machine time in order to reach the maximum production off of the machines. He must keep posted on the present stock of supplies and the volume needed in order to insure supplies needed to be on hand. The planning of the format or layout of the machine room is necessary in order to keep the work flowing through the department from one machine to others in processing order.

Machine Operator III (Accounting Machines).---

Processing: It is the duty and responsibility of the Accounting-Machine Operator to process and maintain the punched-card files that he has been assigned. He has the full responsibility of the accuracy of these files. He must have a thorough knowledge of the processing procedures involved. He confers with his Supervisor only on matters of a technical nature or unusual accounting practices.

Since the nature of this installation is approximately 90% accounting work, the Operator must have a general knowledge of accounting procedures.

As an Accounting-Machine Operator he must have the full understanding of the functions of all auxiliary machines as well as the complete technical experience on our Accounting Machines. He must be able to determine the necessary machine time for each job and to schedule this time on all work that falls under his command. He must assume direct responsibility on all priority processing. He is responsible to the Machine Supervisor for the accuracy and completeness of all reports and must meet all time schedules.

Technical: At least two years minimum experience is necessary on the punch card equipment installed in this installation. Some of the auxiliary machines can be excluded due to the special devices that we have installed. Following is a detailed listing of qualifications needed on the various machines:

1. Key-punch and Verifier: Preparation of drum-card used for feed control. Understanding of the general operations of the key-punch and verifier in order to design card forms to facilitate punching.
2. Sorter: Must understand fully all principles involved, which include card feeding, pocket stops, setting selector switches, alphabetic

and numeric sorting, block sorting, needle sorting, and the functions of the counter mechanism.

3. Interpreter: Must understand all principles involved which included X-eliminators, selectors, zero elimination and special features such as digit emitters.
4. Reproducer: Must have complete knowledge of all principles such as reproducing, gang punching, comparing, summary punching, intersperse gang punching, selectors, X-eliminators, comparing magnets, column split unit, DP and BL column detection, digit emitter, Read X and Punch X unit, and all counter units.
5. Collator: Must understand fully all principles involved, which include special program selection, basic set-up switches, selectors, restoring magnets, primary and 1st sequence units and the split selector unit as a special device.
6. Accounting Machine: A minimum of two years experience in wiring is necessary on the accounting machines in order to have enough background to be versatile in wiring functions. Must understand all principles involved which include all operating switches and signals, the print unit, detail printing of numeric and alphabetic information, zero printing, addition and subtraction, X-selection, digit selection, selective printing, off-set total printing, hammerlock control, group indicating, set-up change switches control, total transfer crossfooting, field selection, class selection, space control, multiple X-selection, machine stop, recognizing negative balances, split column control, summary punching, progressive total printing, run out buttons and gang punch switch and special programming.

In addition to these functions he must be familiar with multiple line printing such as MLP selector system, successive feed, MLP selector expansion, and crossfooting using the MLP selector system.

Since as a special device, the Bill Feed Operations would be required. All comparing aspects as control for printing positions, setting line printing and error stop control.

Analyzing: It is the responsibility of the Machine Operator to analyze all accounts under his control. He must check unusual account transactions to insure the

accuracy of individual account balances. He confers with the Supervisor only on unusual transactions and then only if he does not know the processing steps that are necessary.

Machine Operator I (Key-punch Operator)--Processing: It is the duty of the Key-punch Operator to process all documents received by this department into a punched card. Since very little coding is completed by the departments we service she must have complete knowledge of all coding used, and convert this information into punched card form. The Key-punch Operator must have a general knowledge of the overall operating procedures in order to determine the correct control punching to be used.

She must assume direct responsibility on all priority processing.

She is responsible to the Machine Supervisor for the accuracy and completeness of all punching and must meet all time schedules.

She must have complete knowledge of the maintenance of the customer cash and billing files. She must be able to process all changes, deletions and additions to this file. The basic knowledge of our complete billing system is necessary in order for her to relay customer information to the respective departments.

Technical: Key-punch and Verifier: She must have complete knowledge of the functions of these machines.

For example: Numeric and alphabetical punching, control punching, hand feeding of cards, automatic feeding ejection control, all operating switches, duplicating, program control for skipping and ejection, and multiple column punching.

A summary of the qualifications and experience of the employees in this machine-accounting unit are depicted by the following brief descriptions.

The Superintendent of Machine-Billing and Accounting has been employed by this agency for three years and has been in his present position for one and one-half years. He was initially employed as a Machine Operator III. He is a high-school graduate and has two years of college. His knowledge

of punched-card equipment was obtained through on-the-job training while employed with the Veterans Administration, and through machine courses conducted by the local IBM office. He had five years of experience on punched-card equipment prior to his employment by this agency.

The Machine Supervisor is a high-school graduate. He received his initial training on punched-card equipment through on-the-job training while employed with the Oklahoma Tax Commission. His total experience includes four years with the state agency and one and one-half years in his present position.

In the Machine Operator III job classification, two individuals are employed. Both of these men are high-school graduates. One received his initial training through on-the-job training with a state agency, the other through service schools conducted by the United States Navy. Both had previous punched-card equipment experience; one had three years as a machine operator with a state agency, the other two years while serving in the United States Navy. One of the two had been in the employ of this unit for one year, the other three months.

In the Machine Operator I job classification, key-punch operator, five individuals are employed. All five of these women are high-school graduates. All received their initial training through on-the-job training programs; two

with this agency, two through state agencies, and the other in another state. Two of the five were promoted from billing clerks and have been in their present job classifications for three years. The other three were employed as key-punch operators. These three individuals were experienced key-punch operators at the time of employment. One of the five had been an employee of this agency for seven years, one for six years, one for three years, and two for one year.

Current employment practices.--Sources of Personnel:

New employees are hired for office jobs at the job level in which there is an immediate need. The main sources of personnel for this unit is the local IBM office.

Selection devices: All persons who seek employment are required to fill out an application blank containing general information. A screening interview is then conducted by an individual in the personnel department. The final selection is contingent upon the approval of the unit superintendent. In this unit, applicants for the position of Machine Operator III are given an objective machine operator test designed by the superintendent. It has been the experience of this superintendent that individuals professing to be machine operators know very little about the machines. In this unit, a thorough knowledge of the machines utilized is required. References from previous employment are used in the selection procedure for each individual seeking

employment. No use is made of character references. An extensive physical examination is given. This procedure is followed to comply with requirements set by the insurance company writing the group coverage of employees.

Promotion and salaries: Promotion from within is the exception in this unit. The normal procedure is to hire individuals into a specific job when a vacancy occurs rather than promote from within. Information concerning the specific salaries for the nine jobs was not available for each person. The superintendent did indicate specific salaries in three of the positions and a range in the other position, as follows: Superintendent \$450, Machine Supervisor \$400, Machine Operator III \$370, and Key-punch Operators \$224 to \$260. The salaries reported for this unit indicate that actual salaries paid are above average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized for personnel of this unit are the ability to think analytically and to follow instructions in performing detailed work. It is also required that employees have good memory ability. The superintendent indicated that, because of many detailed jobs, it was difficult to prepare rigid procedures. This requires a need for creative thinking by an individual based on proper analysis of a specific data-processing situation.

Education: A high-school education is required for employment in this unit. Typewriting ability is a necessity for key-punch operators, with training in accounting recommended for machine operators. No special machine preparation is required other than experience on the equipment used; however, it was recommended that individuals in supervisory positions should have the IBM courses as part of their machine background. It should be noted at this point that the superintendent of this unit stated that all key-punch personnel have not been able to retain their typewriting ability after becoming competent key-punch operators.

Experience: Experience on equipment is required for employment. Attempts are made to ensure that key-punch operators have at least one year of experience, and machine operators two years of experience, prior to employment.

In-service education: This unit has no planned in-service education program. On occasion, if needed, employees are sent to the local office of IBM for specific instruction on punched-card equipment.

Machine utilization.--Production: The machines in use are as follows: two Card Punches, one Verifier, one Sorter, two Collators, two Accounting Machines, two Reproducers, one Interpreter, one Adding-Listing Machine, and one Typewriter. No records are maintained to show per cents of time these machines are in operation in each month. The

IBM machines are rented for a monthly fee of \$1,736. The adding-listing machine and the typewriter are owned.

Time and cost savings: A significant saving of time was indicated in a statement from the Superintendent. However, there has been no study to establish definite dollar amounts or percentage figures. It was emphasized that the actual processing costs were greater than under manual operations; however, through increased volume, extra data, and adding of new applications without adding personnel definite dollar savings have been brought about.

Accuracy factor: There were no records kept to indicate whether there has been a significant improvement in accuracy. However, based on statements of the Superintendent, it is assumed that increased accuracy has resulted in definite savings for this agency. It was emphasized that there was a tremendous improvement in accuracy over the manual operation.

Unique problems.--The Superintendent indicated that the main problem encountered in this machine unit is the lack of machine knowledge on the part of applicants who claim to be experienced workers. This prompted him to prepare a comprehensive examination covering machine operation and board wiring for use in the employee selection procedure.

Case No. 6

Wholesale Distribution

Since Case No. 6 is presented in its entirety for illustrative purposes in Chapter III, it is not reproduced here. The interview guide, as used for Case No. 6, and a complete report for the case are presented in pages 86 through 109.

Case No. 7

Wholesale Distribution

This case pertains to the operations of a locally-owned and operated wholesale grocery company. This concern has serviced independent grocers throughout the state of Oklahoma for 30 years. Until 1946 a branch office and warehouse were operated in Tulsa, Oklahoma, servicing the eastern portion of the state. At that time, due to the improvement of roads and equipment, the branch office, and warehouse were moved to Oklahoma City resulting in a considerable saving in operational and office expense. This company at the time of the case interview serviced three-fourths of the state in miles, including approximately 90 per cent of the state's population. The sales volume of this wholesale grocery company ranges from \$12,000,000 to \$15,000,000 annually.

The organizational structure of this business is of the committee type. The committee consists of the President, and Vice Presidents in charge of Purchasing, Sales, and Operations. The responsibility of the machine-accounting unit is

included in the duties of the Vice President in charge of Operations, with a supervisor in direct charge of the actual work on the machines. Because the machines were installed for the purpose of Inventory, they are considered as part of the "Perpetual Inventory Department," referred to as the "P-I Department." The department began utilizing Remington-Rand equipment in 1952.

The total number of employees in this company is 160. Of this number, 30 are salesmen, 17 are in accounting and clerical jobs, and the remaining 113 employees are drivers and warehouse personnel. Of the 17 employees in clerical and accounting jobs within the company, six are in the "P-I Department"--a supervisor, a machine operator, and four clerical workers. The clerical jobs include filing, refiling, and pulling operations.

Machine-accounting operation.--There has been no reduction in the number of employees engaged in clerical and accounting jobs throughout the company due to the use of machines. In fact, the use of machines has required two more employees to carry out the functions of the machine unit as compared to manual operations. In the six years the machines have been used in the operation of the Perpetual Inventory Department, the number of employees has never exceeded six. At the time the machines were installed, two persons were employed in this department; however, expansion of the

department was required because, even though machines were used, the perpetual inventory was always two to three weeks late.

In this operation, Tuesday, Wednesday, and Thursday of each week are the peak operational days for the department using punched-card equipment. No overtime, as such, is required to process any of the data of this company because they work a 50- to 60-hour week.

In the opinion of the vice president interviewed, this concern could not go back to a manual operation unless they cut their volume back by at least one-third. No estimate would be ventured regarding the number of additional persons who would be required to do manually what is currently done by machines. Through the use of punched-card methods, management now has up-to-date perpetual inventory records that were not available to any degree of completeness when manual "pen-and-ink" methods were in use. Because of the completeness of the inventory records through the utilization of machines, this concern is able to operate on less capital and lower inventory than with manual methods of inventory control.

Specific accounting functions.--Machines were originally installed to improve the perpetual inventory records. It is the claim of this company to have initiated the first all-alphabetic punched-card listing for inventory purposes;

the typical procedure is to assign numbers to each product. This technique required no change in the sales routine. The vice president spoke with pride when he stated, "We made the machines fit our business rather than the business fit the machine." A natural addition to the function of inventory control was the preparation of purchases requisitions for the purchasing department through the use of low-stock indicator cards. This is a card that is placed at a point in an inventory deck indicating that the number of items of a specific type is down to the point of re-order. A unique procedure in the operation of this unit is the card-pulling sequence from the inventory file. The most commonly used method is to pull cards from the low number of a sequence to the high number in filling orders. This requires a calculation to arrive at an inventory--high number minus low number, plus one. The company pulls cards from the high numbers of the sequence in filling orders; therefore, the last card--high number of the sequence--is the number of items on hand. In this type of operation, the pulling clerk probably has the most important job, since the correct filling of the order and the preparation of the invoice depends on the accuracy of the pulling of cards representing a specific product.

At the present time, it is anticipated that profit calculations will be added to the functions of the unit. This function is being added because it is apparent that an

extensive clerical burden in the manual calculations of profit on each item in stock, can be drastically reduced with the addition of one piece of equipment. Also it is anticipated that there will be a definite saving of time and salary expense. Three clerical workers will be eliminated when this change is put into effect.

Machine-accounting personnel.--The six employees that constitute the personnel of this department have specific job titles, but no attempt has been made to formalize job descriptions.

The Supervisor responsible for the fulfillment of the functions of this department has been employed with this company for six years and has been the supervisor of the department for five years. This person was initially employed as a re-file clerk. She is a high-school graduate. Her training on punched-card equipment was by means of on-the-job instruction from representatives of the machine manufacturer. This person's experience includes employment in grocery store operations, one year as a re-file clerk, and five years as the supervisor.

The Machine Operator has been employed with the company for six years. He was originally employed as dock worker, but due to an injury he was unable to carry on in that type of work. Because of his knowledge of the wholesale operation, based on his experience in the warehouse, he

was transferred into the "P-I Department" as a file clerk. He is a high-school graduate and received his initial training on punched-card equipment on-the-job with this concern. His only business experience has been with this concern, consisting of two years in the warehouse, three years as a file clerk, and one year in his present position as machine operator.

In the File Clerk job classification four individuals are employed. Two of the five have been employed within the past year and two within the month prior to the time of the case interview. These file clerks are women and all are high-school graduates. All four of these individuals have had experience as grocery store checkers and stockers prior to employment with this concern.

Current employment practices.--Sources of personnel: New employees are hired in this department as file clerks and a policy of promotion from within is followed. The chief source of personnel for this department is a private employment service. There is an agreement between the company and the employment service that no one will be sent out for an interview that is not qualified for employment based on exact qualifications submitted to the employment service.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. Upon completion of the application blank, a

personal interview is conducted by the Vice President in Charge of Operations who hires for all departments. References from previous employment and those to indicate the character of the individual under consideration are used in the selection procedure. No use is made of tests, nor is a physical examination required.

Promotion and salaries: Promotions are primarily within and an individual is up-graded when a vacancy occurs if possible. It is also the policy of this company to promote persons in lower-level jobs in other departments into the machine unit when a vacancy occurs in the file clerk position. Information concerning specific salaries for the six jobs in the department was not available. The person interviewed did indicate that the starting salary for all basic positions was one dollar per hour. Because of the extended length of the normal work week, the salaries in this machine-accounting unit probably are only average or even below average compared with those revealed by the salary survey of Oklahoma City made by NOMA for 1958.

Qualifications of employees.--Statements pertaining to qualifications for employment in this phase of accounting work are based on present company policies and the opinion of the Vice President in Charge of Operations.

Personal traits: The personal traits emphasized for personnel of this department are physical stamina and good

vision. Because of limited space, limited stature is considered a necessary personal trait. All employees in this department must be small in size. Also no left-handed persons are employed because standard office equipment and furniture is basically designed for right-handed persons. This arrangement causes confusion in procedures in the office when persons are shifted from one work area to another.

Education: There is no minimum school requirement; the only specific requirement for any of the jobs is that the individual be able to read.

Experience: Experience on equipment is not required for employment. In this department, when possible, persons are required to have previous grocery experience, either in other jobs within the concern or as stockers or checkers in other grocery organizations.

In-service education: This company has no specific in-service education program. Individuals are employed as file clerks and learn the operation of the department in that position.

Machine utilization.--Production: The machines in this unit were utilized in 1957 as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch.	75
Sorter.	75
Accounting.	75
Reproducer.	80

This equipment is rented for \$850 per month.

Time and cost savings: A significant saving of time and cost was indicated, but there has been no study to establish a definite dollar amount or percentage figure on the saving. The saving is based on the fact that with machines, records and reports are more complete and are prepared with more speed and accuracy. The concern currently operates on less money and less inventory than under manual methods, even though business has increased more than 50 per cent during the time in which the machines have been used.

Accuracy factor: There were no records kept to indicate whether there is any significant improvement in accuracy. However, it was stated by the person interviewed that under manual methods there were many errors as compared to current machine methods.

Unique problems.--From the standpoint of management, there are no problems that could be directly chargeable to machine utilization. When asked if machines caused a personnel problem at the time of installation, the individual replied that "most persons were tickled to death." This may be attributed to the general policy of this concern on any new equipment or procedure. The employees who will be effected by a proposed change are brought in and consulted on the operational aspects of the change and how it will fit into the total operation of the wholesale grocery concern. It is the basic philosophy of management in this concern

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that each employee is a part of the total operation and that no piece of equipment or procedure is any better than the person who puts it into operation.

Case No. 8

Wholesale Distribution

This case pertains to the operations of the Record Department of a wholesale distributor of hardware and appliances, electronics parts, and records. Under the organizational structure each department operates as a separate company in itself. Each department is headed by a sales manager who is responsible for the operations of his department. The basic company has been in operation for 53 years. The Record Department, the only department using punched-card equipment, has been in operation since 1941. This case will be concerned only with this one department. It is the franchised distributor for Oklahoma and Texas of one of the leading recording companies of the record industry. It also has the distributorship for the recording company's record players and sundry supplies for all types of recording equipment.

The total average number of employees of this company was not available from the person interviewed for this case study. There are, however, 15 employees engaged in clerical and accounting jobs; and the other employees of this concern are engaged in the distributive phases of the total operation.

The organizational structure places responsibility for the operation of the punched-card machines with the Sales Manager of the department who is also in direct charge of the sale and distribution of records, recording equipment, and supplies. This person is directly responsible to the president of the company. The machines are not considered as a machine unit, but merely considered as a tool to carry out the functions of this one department.

This department has been in operation since 1941; however, the machines were not installed until 1950. Machines were installed on the recommendation of the recording company to fulfill the function of inventory control. This is a very important factor in the record business, because of the perishable nature of the product--a certain record may be a hit today and in no demand tomorrow. Because of this factor and the large number of items required in inventory, the recording company devised the system; and, through a contract with Remington-Rand, made it possible for their distributors to use a punched-card system at a reduced rate. It was indicated that this specific company would not have installed such equipment had it not been for this agreement.

Of the 15 employees in clerical and accounting jobs, three are employed in the Record Department: two machine operators and one billing clerk. The Sales Manager is not considered as being in an accounting position.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. The use of machines has continuously expanded the amount of work accomplished but at no time has a machine ever replaced an employee. In the eight years the punched-card equipment has been in operation, the number of employees has never exceeded three. In the opinion of the Sales Manager, the three persons currently employed constitute an adequate staff for present operations. It was estimated by the sales manager that two additional persons would be required to do manually what is currently done by machines.

Because of an increase in sales over the period of machine utilization, the sales manager could not state specifically the effect of machines on peak load operations. It was indicated that machines have done away with any overtime operations.

Specific accounting functions.--The functions of this machine-accounting unit at the time of installation were inventory control, billing, and statistical work for sales analysis. The basic reasons for installing machines were for speed and accuracy. Records are considered perishable items and the up-to-date sales and inventory records give immediate information on which to base decisions. At the same time the machines took over these functions, one combination

inventory and billing clerk was discharged. The dismissal of this person was due only in part to machine utilization, a temporary business recession was the main reason for dismissal.

At the present time, no other functions are to be added to the machines in use because of the division of this company. Other departments of the company see no need for machine utilization. As mentioned previously, this installation was made upon recommendation of the record company issuing the franchise and not as a possible company-wide operation.

Machine accounting personnel.--The four employees that constitute the personnel of this department have specific job titles but no attempt has been made to formalize job descriptions.

The Sales Manager is responsible for the fulfillment of the functions of this unit. He has been employed with this company for 17 years and has been the Sales Manager of the Record Department from its beginning. His knowledge of punched-card equipment was obtained on the job under the supervision of a machine-company representative who helped install machines and train personnel for a period of two months. The actual work experience of this individual includes several years of sales work and 17 years in his present position.

In the Machine Operator job classification two women are employed. Both are high-school graduates and received their initial punched-card equipment training on the job with this company. Both of these women had general clerical experience prior to employment with the company. One of the two has been an employee of this department for 15 years, eight years in her present position. The other person has been an employee for six months.

The Billing Clerk is a high-school graduate. Her machine work is limited to the operation of the tabulating machine. The training in the operation of this machine was received on the job with this company. Her work experience includes clerical work in other business concerns and six months in her present position.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is an immediate need. The sources of personnel for this department are private employment agencies.

Selection devices: All persons who seek employment are interviewed by the Sales Manager only. In the selection process, only references from previous employment are used.

Promotion and salaries: Promotion is primarily from within. Individuals are up-graded if possible when vacancies occur. Information concerning the specific salaries for the four jobs in the Record Department was not available. The

Sales Manager did indicate the range of salaries in two of the positions; Machine Operator \$250 to \$300 and Billing Clerk \$175 to \$200. No information relative to the Sales Manager's salary was stated. The range in salaries reported for this machine-accounting unit indicates that probably the actual salaries paid are average as compared with the information revealed by the salary survey made by NOMA for 1958 in Oklahoma City.

Qualifications of employees.--Statements pertaining to qualifications for employment in this phase of accounting work are based on present company policies and the opinion of the Sales Manager of the unit.

Personal traits: The one personal trait emphasized for personnel of this department is the ability of the individual to adapt to extreme detail in work performed.

Education: There is no minimum school requirement, although all persons employed are high-school graduates. There are no specific course requirements for any of the jobs; however, a knowledge of basic accounting would be an asset for employees in this department.

Experience: Experience on equipment is not required for employment. It was indicated by the person interviewed that an experience rule would be too hard to follow because of the relative newness of punched-card operations in this geographic area.

In-service education: This company has no formal in-service education program. Two to three weeks' of on-the-job training, under the supervision of the senior employee in the department, is the extent of any in-service education program for machine-accounting personnel.

Machine utilization.--Production: The machines in use and the average percentages of time in operation are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card punch	25
Sorter	25
Accounting	25
Adding-listing	--

The Remington-Rand machines are rented for a monthly rental of \$105.

Time and cost savings: A significant saving of time was indicated, but there has been no study to establish any definite dollar amount or percentage figure on savings. It was indicated, however, that a monthly re-cap of sales by dealers took a week to prepare manually compared to four hours by machines.

Accuracy factor: There are no records kept to indicate whether there is any significant improvement in accuracy. However, based on the statements of the Sales Manager, it is assumed that accuracy has meant a definite saving. He related that one dealer made a thorough check of all invoices

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received for a period of six months and did not find any errors. It was indicated that there were no errors in machine preparation of invoices compared to numerous errors in manual preparation.

Unique problems.--No specific problems unique to a machine operation, other than the difficulty in hiring experienced personnel, were indicated. This installation is unique in that it is limited to record distribution in this company and it is the only record distributor in Oklahoma with a machine operation. It was indicated that dealers are very complimentary of the service rendered and are pleased with the machine-prepared invoice compared with the previous manually prepared invoice.

Case No. 9

Wholesale Distribution

This case pertains to the operations of the regional accounting office of one of the major automobile manufacturers. The office was opened in 1931 as a parts depot. The present operation includes the distribution of and accounting for parts and accessories to authorized dealers and automotive repair shops. The consolidation of outlying accounting operations into a regional accounting office was accomplished in 1956. The regional accounting office is the centralized accounting office for the southwestern region comprised of 11 states.

The average number of employees in accounting and clerical jobs is 65.

The organizational structure places responsibility for the operation of the machine-accounting unit with the controller. A Supervisor of Accounts Receivable is in direct charge of the unit with a senior tabulating operator overseeing the actual operation. The unit is called the "Accounts Receivable Unit." The machine unit has been in actual operation for two years. Individuals were assigned to the unit six months prior to the installation of the machines, to establish procedures and prepare the way for the change to punched-card operations. Machines were installed to fulfill the accounts receivable function, which is the only function of this unit. This includes the recording of sales and receipts of cash to accounts receivable, the billing of accounts receivable, and the preparation of special reports concerning accounts receivable and sales.

Of the 65 employees in clerical and accounting jobs, 31 are employed in the accounts receivable unit: the Supervisor of Accounts Receivable, one Senior Tabulating Machine Operator, four Tabulating Machine Operators--B, one Supervisor of Order Processing, one Senior Comptometer Operator, seven Key-Punch Operators, fifteen Accounting Records Clerks, and one Posting-Machine Operator. The supervisory personnel, machine operators, and the senior comptometer operator are considered to be the key personnel in the unit.

Machine accounting operation.--There has been a definite increase in the number of employees engaged in clerical and accounting jobs in this office due to centralization of accounts receivable and an increase in the number of accounts handled. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. Centralization of this function eliminated accounts-receivable clerks in the outlying offices of the region. These persons were absorbed in other positions which they were qualified to fill. In the two years the punched-card equipment has been in operation, the number of employees has increased from four, in the set-up installation, to the 31 currently employed. In the opinion of the Supervisor, the 31 persons currently employed constitute an adequate staff for present operations. It was estimated that the personnel of this department would have to be doubled to do manually what is currently done with machines.

Specific accounting functions.--The function of this accounts receivable unit has not changed from the time it was installed two years ago. It carries out the typical accounts receivable functions of recording sales and billing customers plus reports to management regarding accounts receivable and sales. At the present time, there are no anticipated changes in the functions performed.

Machine-accounting personnel.--The 31 employees that constitute the personnel of this unit have specific job titles, but no attempt has been made to formalize the job descriptions.

The Supervisor of Accounts Receivable, who is responsible for the fulfillment of the functions of this unit, has been employed with this company for five years. He has been in his present position for two years. He is a high-school graduate and has attended one of the major universities in the southwest as a special student, accumulating as many hours of accounting as possible. He has had no formal training on punched-card equipment, his knowledge of its operation has come from working with the equipment and studying and reading material pertaining to its operation. He had extensive accounting experience with a railroad company in Texas prior to joining his present employer.

The Senior Tabulating Operator is a high-school graduate. His source of initial training was on-the-job training while employed with the Oklahoma Employment Commission. His total experience includes at least five years of punched-card work in the state installation, and two and one-half years in his present position.

In the Tabulating Operator--B job classification, four individuals are employed. All are high-school graduates. Two of the four received their initial punched-card equipment

training through the local IBM office, one through on-the-job training in a business concern in another state, and the other through on-the-job training with this company. Two of the four persons are long-service employees, one having been promoted from the accounts payable unit where he was a posting-machine operator; the other promoted from general accounting where he was a price clerk. The first individual has been in his present position six months, the second two years. Of the other two persons, one has been in the employ of this company two and one-half years, the other two years. Both were employed initially in their present positions.

The other employees of this unit are all high-school graduates and their experience varies. In most cases the key-punch operators were comptometer operators transferred to key-punch jobs at the time the change from manual methods took place.

Current employment practices.--Sources of personnel:

New employees are hired for office jobs at the job levels in which there is an immediate need. The source of personnel, as a general rule, is through advertising. The advertisement lists specific job openings with replies addressed to a box number.

Selection devices: All persons who seek employment are required to fill out an application blank containing general information. Upon completion of the application

blank, an interview is conducted by the supervisor who has complete control over the selection of individuals for jobs in this unit. Tests are not used as a general rule; however, occasionally, if the situation warrants, aptitude and personality adjustment tests are administered to applicants to aid in selection. References from previous employment are used in the selection procedure for each individual seeking employment. All experience listed is verified. A general physical examination is required. It was indicated that as a general rule no physical handicap would eliminate a person from employment; however, each individual must be able to get around quickly and be able to lift trays of cards in carrying out the duties required.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when a vacancy occurs. This company also likes to promote from other departments when possible. Information concerning the specific salaries for the 31 jobs in the unit was not available. The supervisor did indicate that the starting salary for machine operators was \$290 per month. Also, from observation and contacts with other supervisors, he stated that his salaries were considered to be high for employment in punched-card accounting installations in Oklahoma City. No other information concerning salaries was given. The starting salary reported for this unit indicates that probably the

actual salaries paid are above average as compared with the salaries revealed in the NOMA salary survey.

Qualifications of employees.--Statements pertaining to qualifications for employment are based on stipulated company policies and the opinions expressed by the supervisor.

Personal traits: The personal traits emphasized are nice appearance, ability to get along well, conscientiousness, and punctuality. In addition to these, supervisory personnel should possess the ability to supervise and gain respect.

Education: A high-school education is required for employment. No specific courses were indicated as necessary for the preparation for this type of work. No special machine preparation is required of machine operators other than experience on the equipment. However, the supervisor believes that the manufacturer's special schools are essential to the experience of the individual. Key-punch operators are expected to have attended the key-punch school in their early training.

Experience: Experience on equipment is required for employment. Attempts are made to insure that key-punch operators have at least two years of experience, and machine operators at least three years. It was indicated that the supervisor of the unit should have had at least five years' experience including supervision and extensive board wiring.

In-service education: This company has no planned in-service education program. However, instruction by the supervisor is given for specific jobs when needed.

Machine utilization.--Production: The machines in use and the percentages of time in operation where known are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (5)	50
Verifier (4)	50
Sorter (3)	42
Collator (2)	34
Interpreter.	--
Accounting	75
Reproducer	25
Tape-to-card converter (4) . .	34
Calculator	58
Adding listing (3)	--

The percentages of time in operation are based on a 24-hour day. In this company the outlying locations use typewriter-to-tape machines to send accounting data to the centralized office. The IBM machines are rented for a monthly fee of approximately \$5,000.

Time and cost savings: A significant saving of time was indicated in statements from the supervisor. However, there has been no study to establish definite dollar amounts or percentage figures. An example of the savings is shown when the operational capacity of the manual procedures of 100 lines per hour in recording accounts receivable is compared with 100 lines per minute utilizing punched-card equipment.

Case No. 9

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. However, it was indicated that part of the routine in this accounts receivable unit was to check for accuracy, which would indicate that the accuracy factor would not be significant in comparing the two methods of data processing.

Unique problems.--The supervisor indicated that the main problem encountered in changing from a manual method to the machine method was that both management and employees looked on the punched-card equipment as infalliable. After a short period of adjustment, there was a better understanding of the equipment and its capacities. From the standpoint of management, there were no problems involving personnel that might be directly chargeable to machine processes. Normal attrition and increased volume has made unnecessary any special provision for persons temporarily not needed during the changeover period.

Case No. 10

Wholesale Distribution

This case pertains to the operations of a heavy road-equipment sales and service company. This concern has the franchise for one of the leading producers of this type of equipment for the western half of the state of Oklahoma. The company operated as a partnership for 13 years, being

incorporated under its present organizational structure for the past five years. The Oklahoma City office is the main office. Two branch stores are operated, one in Altus and the other in Woodward. The income of this company is from the sale of new and used equipment, parts, and service. The average yearly gross income is \$7,000,000.

The organizational structure places the responsibility for the operation of the machine-accounting unit with the comptroller; a supervisor is in direct charge of the actual work in the unit. This machine unit is called the "Machine-Accounting Department" and operates in conjunction with the general accounting department. The present machine unit utilizing IBM equipment has been in operation for four years. Machines were first installed for parts inventory, accounts receivable accounting, and billing.

The total number of employees in this company is 150. Of this number, 15 are employed in accounting and clerical jobs, (9 are in the main office, and three each in the two stores), the remaining 135 employees are sales, parts, and service personnel. Of the 15 employees in clerical and accounting jobs, three are in the machine-accounting department; a supervisor, a machine operator, and a key-punch operator. The machine unit is a centralized operation, the information for machine processing coming from the two stores as well as the home office.

Machine accounting operation.--Due to the use of machines, there was a decrease in the need for two persons in clerical and accounting jobs and seven parts workers. These nine persons were discharged at the time of installation of punched-card equipment and have not been replaced. In the four years the machines have been used in the accounting operation of this concern, the number of employees has never exceeded three. At the time the machines were installed, three persons were transferred from the accounting department into the machine-accounting department. The supervisor and machine operator have held their positions since the beginning of the machine unit.

In this company, the use of machines caused an increase in peak loads, brought about because of an extension of cut-off dates, and the elimination of a waiting period before new orders were processed. For example, in the billing procedure and preparation of invoices of sales, under the manual method the cut-off date for billing accounts receivable was the 20th of the month, and no invoicing was done until the 10th of the following month. Through the use of machines, the cut-off date was extended to the 27th of the month, and there was no stoppage of the invoicing process. This causes peak-load periods as billing of accounts receivable and normal end-of-the-month statements and reports come at the same time. Three to four hours of overtime now

are required two nights per week, in addition to a normal 44-hour work week, to complete the operations of this machine-accounting unit. In the opinion of the supervisor, nine additional persons would be required to do manually what is currently done by machines. The supervisor also feels that the three persons currently employed do not constitute an adequate staff for present operations; one machine operator is needed to eliminate the overtime work. Also, this would relieve the supervisor of detail work, that is not ordinarily required of a supervisor, and allow him to devote his time to procedures and systems work. It was indicated, however, that the addition of this person is not being considered at the present time.

It should be noted that machines were originally installed because the owners were of the opinion that punched-card accounting was vitally needed to improve the accounting operations. This company started their machine-accounting operation without any extensive background work. Personnel from the accounting department were sent to the local IBM office for basic training in machine operation, without previous consultations. The functions of inventory control, sales analysis, and preparation of invoices, all high card count operations, were the initial functions performed by the machines. The extremely heavy work load and the lack of any extensive preparation for machines nearly proved

disastrous. The personnel, who were inexperienced in punched-card machine work, did their best, but they could not keep up on the inventory of 16,000 items. For six months to a year it was impossible to rely on the machine results for perpetual inventory. The work of sending statements of accounts receivable was behind six months and it was a major chore preparing invoices on current billings to customers.

This installation is now running very smoothly and the company is able to offer better service to its customers than when manual methods were in use. The main problems of the department have been overcome, additional functions have been added, and new functions are being planned. The supervisor recommended that a new installation should attempt only one function at the time of change from manual to machine methods, new functions should be added only when an existing function becomes a nearly automatic operation.

Specific accounting functions.--Machines were originally installed to carry out the major accounting function of inventory control (consisting of 16,000 items), preparation of invoices in the billing procedure, preparation of statements, and analysis of accounts receivable. At a time when these functions were being accomplished to a high degree of efficiency, inventory of new and used machines and accounts payable were added to the existing functions. These functions were added to more fully utilize the equipment in terms

of the rental cost involved. The addition of these two functions caused no reduction in personnel.

At the time of the interview, this company was preparing for the addition of payroll accounting to the functions of the unit. It was anticipated that no reduction in personnel would come about because of this change. The accounting personnel responsible for the manual preparation of payroll would be released from the extreme detail of a payroll to do other accounting work of a higher level.

Machine accounting personnel.--The three employees that constitute the personnel of this unit have specific job titles, but no attempt has been made to formalize job descriptions.

The Supervisor of this department has been employed for ten and one-half years and has been in his present position for four years. He was initially employed as a book-keeping clerk in the accounting department. He is a high-school graduate and has attended business college, where he received his formal accounting education. His training on punched-card equipment has been on the job and six weeks of night school offered by the local office of the machine manufacturer. This person's total experience has been in the employment of this company.

The Machine Operator has been employed for six years. He was initially employed as a bookkeeper in the accounting

department. He is a junior-college graduate and received his initial training on punched-card equipment through on-the-job training and six weeks of night school offered by the local office of the machine manufacturer. His total experience includes two years as a bookkeeper and four years in his present position.

The Key-Punch Operator is a high-school graduate. She received her initial training as a key-punch operator at the local key-punch operators' school conducted by the machine manufacturer. Her total experience includes several years as a key-punch operator with other business firms, and two and one-half years in her present position.

Current employment practices.--Sources of personnel:

New employees are hired at the job level in which there is an immediate need. To date, personnel for this department have been transferred, for the most part, from the accounting department. When new employees are needed, they have been employed upon recommendation from the local IBM office which maintains a list of employable people but is not an actual placement business.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. A personal interview is then conducted by the Supervisor who hires all personnel for his department. References from previous employment are considered in the selection

procedure. A physical examination is required of all individuals; however, only major handicaps will eliminate an individual from employment.

Promotion and salaries: To the present, there have been no promotions within or into this unit other than at its beginning. The hourly rate for two of the three jobs was indicated to be: \$1.70 for the Machine Operator and \$1.55 for the Key-Punch Operator. The salary of the Supervisor was not stated. Based on the information that the normal work week is 44 hours plus overtime of six to eight hours, it is assumed that the actual weekly salaries of these two individuals is above average for the Machine Operator and average for the Key-Punch Operator as compared with the information revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized for personnel in this unit are the ability to comprehend quickly and to analyze.

Education: A high-school education is the minimum school requirement for all positions. It was emphasized that the supervisor should have some formal education in accounting. Formal instruction in accounting would be helpful to the machine operator, but not a must item. The key-punch operator should be able to typewrite and proficiency in the operation of a ten-key adding-listing machine is of value.

Experience: When possible, experience is required for employment in the key-punch operator position. In the future, when a need arises, machine operators will be required to have at least one year of punched-card experience. It is the opinion of the Supervisor of this unit that a person employed in his position should come from within the company. He believes that a thorough knowledge of the company and its operation is essential for the person in direct charge of a machine-accounting unit.

In-service education: No specific in-service education program is in operation at present. At the time of installation, personnel were sent to a six-week night school conducted by the local IBM office.

Machine utilization.--Production: The machines in use at the time of the interview were: one Card Punch, one Sorter, one Accounting Machine, one Reproducer, one Collator, and one Interpreter. This IBM equipment is rented for approximately \$1,200 per month. No records were kept to indicate the percentage of time in operation. It was indicated that all machines are operated as near to continuously as possible.

Time and cost savings: A significant saving of time and cost was indicated, but there has been no study to establish a definite dollar amount of percentage figure. This machine unit is considered as a service bureau and the cost of its operation is charged to the departments according to

the use made of punched-card methods by each department. The preparation of monthly reports illustrates the saving of time and the speed of operation of the machine method of accounting. A continuous operation was required in manual preparation of monthly reports, as compared to only hours of operation using machine methods. Reports are available at any time they are needed because of machine utilization.

Accuracy factor: There are no records kept to indicate whether there is any significant improvement in accuracy. However, it was stated by the person interviewed that the speed of operation tends to override accuracy in this unit. Errors are more readily caught on the machines than in manual operations.

Unique problems.--At the present time, there are no problems that can be directly charged to machine utilization. The major problem of this machine-accounting unit occurred at the time of installation. The Supervisor reported that the detail of procedures was overlooked because of the excessive number of functions that were first attempted. As an example, in inventory control a card for each item, regardless of issue quantity, was punched. At one time 7,000 cards were punched representing bolts, rather than dividing the cards into units of 10's or 100's the issue quantities of these items. The problems of procedure have been overcome and currently this unit is operating very efficiently.

Wholesale Distribution

This case pertains to the operations of a branch warehouse and office of a wholesale grocery company. The home office of this company is located in Topeka, Kansas; and two other branch operations are located in Kansas City, Kansas, and Wichita, Kansas. This branch operation was opened in 1941 to service affiliated independent grocery stores in Oklahoma. Since that time, territories have been expanded to include the Northern and Panhandle areas of Texas. Three hundred grocery stores are serviced out of this branch warehouse and office. The branch operation has an average gross sales volume of \$30,000,000 per year. The average number of employees is 225. Of this number, 200 are employed as buyers, supervisors, engineers, warehouse personnel, and truck drivers. The other 25 employees are engaged in clerical and accounting jobs.

The organizational structure places responsibility for the operation of the machine-accounting unit with the office manager; a supervisor is in direct charge. The unit is called the "IBM Department." The department has been in operation for approximately 17 years. Machines were first installed to fulfill the functions of invoicing and inventory control.

Of the 25 employees in clerical and accounting jobs, 11 are employed in the IBM Department: one Supervisor, two

full-time Machine Operators, two part-time Machine Operators, two Key-Punch Operators, and four General Clerks.

Machine accounting operation.--There has been a steady increase in the number of employees engaged in clerical and accounting jobs due to an increase in business volume. The use of machines has aided in keeping the accounting functions abreast of this increased volume. In the 17 years of operation the number of employees has increased from four to eleven. In the opinion of the Supervisor, the eleven persons employed constitute an adequate staff for present operations. A few hours of overtime are required of the machine personnel twice a year during physical inventory. There is no overtime during normal operations. It was estimated that five times the current number of persons would be required to do manually what is now done by machines.

Specific accounting functions.--The functions at the time of installation were invoicing and inventory control. Each order is invoiced out, using pre-punched cards. The cards contain complete information for each item in order. Inventory control is maintained through the use of the pre-punched cards representing items in stock. The method of pulling cards from perpetual inventory files, from the low number of a sequence to the high number, is utilized in this unit. This requires a calculation to arrive at an inventory figure, high number minus low number plus one. This method

of pulling cards allows for a check, required by the purchasing department, on the last items in and the total number in the shipment.

At the present time, it is anticipated that accounts payable and accounts receivable will be added to the current functions. It is thought that the clerks currently handling these operations manually, will be transferred to the IBM Department to assist in carrying out these functions. This anticipated change is to increase the accuracy of these processes.

Machine accounting personnel.--The 11 employees that constitute the personnel of this department have specific job titles, although no attempt has been made to formalize their job descriptions.

The Supervisor responsible for the fulfillment of the functions of this department is a high-school graduate and has completed two and one-half years of college work. He received his initial training on punched-card equipment from the local IBM office. He was employed as the Supervisor and has held the position for 13 years.

In the Machine Operator classification there are two persons employed, one man and one woman. Both are high-school graduates and received their initial training on punched-card equipment with this company as on-the-job training. The man had been promoted from another department where

he had been employed for several years. He has been in his present position two months. The woman was promoted from an Order Clerk position. Her total experience includes one year in clerical work and three years in her present position.

There are two part-time Machine Operators. Both are high-school graduates and are now attending college. Both men received their initial training on punched-card equipment through on-the-job training with this company. One of the two has been employed for two years, the other for six months.

In the Key-Punch Operator job classification there are two women. Both are high-school graduates. One of the two received her initial key-punch training through a local business college the other through the local IBM office. Both were promoted from clerical positions, one after two years, the other after one year. These two women have been in their present positions seven and two years, respectively.

In the Clerk job classification there are four people. This job involves filing and pulling pre-punched cards from the perpetual inventory tub files. The four girls are high-school graduates with no previous full-time work experience. One of the four has been employed for two and one-half years, two of the four for one year and the other for three months.

Current employment practices.--Sources of personnel:

New employees are hired for office jobs at the job level in

which there is an immediate need. The sources of personnel are the local IBM office and private employment agencies.

Selection devices: All persons who seek employment are required to fill out an application blank containing general information. Upon completion of the blank, an interview is conducted by the office manager. The final selection of an individual is contingent upon the approval of the department supervisor. A general knowledge test is administered to all applicants. Previous employment and character references are requested from each individual. No physical examination is given. However, any physical defect that would hinder a person's ability to move, or might become aggravated by excessive standing will eliminate an individual from consideration for employment.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when a vacancy occurs. Information concerning the specific salaries of the 11 jobs in the machine-accounting unit was not made available. The supervisor did indicate that the starting salary was one dollar per hour with an automatic raise at the end of a three-month period. From that time on, raises are based on merit. The information concerning salaries indicates that probably the actual salaries paid are average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal Traits: The personal trait emphasized for people in this unit is the ability to get along with others. This trait is emphasized because the machine room is small, requiring individuals to work quite close together.

Education: There is no specific educational requirement; a high-school education is recommended. No specific subjects are considered as necessities for employment; however, a good background in mathematics and accounting is recommended. No special machine preparation is required other than experience on the equipment. It was indicated by the supervisor that persons employed in the supervisor and machine operator positions should attend the technical courses of the machine manufacturer when possible. Also, the ideal situation would require that key-punch operators attend the key-punch school conducted by the local IBM office.

Experience: Experience on equipment is not required for employment. It was the opinion of the supervisor that IBM schools would take the place of actual machine experience.

In-service education: In-service education consists of a very short orientation program of company operations presented to all new employees.

Machine utilization.--Production: The machines in use and the percentage of time in operation where known are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (2)	75
Sorter (2)	50
Accounting Machine	90
Reproducer	95
Summary Punch.	90
Adding Listing	--
Typewriter	--

The IBM machines are rented for a monthly fee of approximately \$1,000.

Time and cost savings: A significant saving of time was indicated; however, there has been no study to establish definite dollar amounts or percentage figures. The supervisor thought a study would show that it takes only hours to complete a specific function with machines, compared to days necessary to complete the same function manually.

Accuracy factor: No records are kept to indicate whether there has been a significant improvement in accuracy. However, the supervisor stated that there has been a definite improvement in accuracy in both invoicing and inventory control.

Unique problems.--The supervisor indicated that there were no specific problems encountered in this branch office because the punched-card machines were installed at the time of its opening.

Wholesale Distribution

This case pertains to the operations of a district office of a national distributor of automotive parts and equipment. The home office is located in Akron, Ohio. This office has jurisdiction over the state of Oklahoma and a part of Texas. There are 22 stores that are sub-units of this office. The gross sales volume is between \$10,000,000 and \$15,000,000 per year.

A pre-determined manual of operations is prepared that sets the type and number of machines to be used, and the procedures to be followed. This operating manual is based on the volume of business conducted by each district office. This tends to hamper a district that is at the top of a volume range. In some instances, the business volume is such that the machines provided for in the table of organization are not adequate for satisfactory operations.

The average number of employees of this district office is 50. Of this number, 25 are employed in the operations department, and the remaining 25 employees are engaged in the actual distributive phases of the total operation.

The organizational structure places the responsibility for the operation of this unit with the office manager, who is responsible to the district manager. A supervisor is in direct charge of the unit. The unit is called the "Machine Room," and is not considered as a separate unit at this level

of operations. This machine-accounting operation has been in effect approximately one year. Machines, however, have been used for quite some time at the regional level. Machines were first installed to fulfill the billing, accounts receivable, stock control, and statistical functions. This extensive use of machines caused no problem because of previous company use of machines at higher organizational levels.

Of the 25 employees, in operations department jobs, seven are employed in the machine-accounting unit--the office manager, supervisor, programmer, and four card-a-type operators. The latter individuals spend one-half their time operating the card-a-type machines and one-half filing pre-punched cards in tub files.

Machine-accounting operation.--This company had just completed an extensive reorganization of district office procedures. The installations of machines was part of this reorganization. The machines have continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the one year the unit has been in operation, the number of employees has never exceeded seven. In the opinion of the Office Manager, the seven employees should be increased by two card-a-type operators and one accounting-machine operator, to bring the personnel of this unit up to a point of more efficient processing of

accounting information. However, because of a strict Table of Organization established by the home office, no additions of personnel are possible until the volume of this unit increases. Because of the extensive reorganization no estimate was made concerning the number of individuals that would be required to do manually what is now done by machine. It was pointed out that regional and higher organizational units have utilized punched-card equipment for a number of years and that some of the processing previously accomplished at the regional level has been moved down to the district level because of the installation of machines.

Work is programmed to eliminate any peak load operation and all work is on a current basis. To accomplish this, it was emphasized that there was no official overtime. This Office Manager further stated that there would always be some overtime, but the machine utilization more than offset any additional expense in overtime salary. Through the use of punched-card methods the local management now receives reports of value that were not even envisioned when manual methods were in use. For example, a daily sales report is prepared for each company store, broken down into 30 categories, showing units and dollar sales for each sales person.

Specific accounting functions.--The functions of this unit at the time of installation were billing and accounting

for accounts receivable, inventory control and sales analysis. These functions were programmed for a nation-wide application in 51 district offices. The general effect on personnel in this office, as well as the others, was the releasing of accounting and clerical workers from excessive clerical burden allowing them to perform higher level duties requiring human decisions.

At the present time, it is anticipated that as machine time becomes available this unit will expand the current functions to include other accounting-data processing that is readily adaptable to machine procedures.

Machine accounting personnel.--The seven persons that constitute the personnel of this unit have specific job titles. At the time the case study interview was conducted, formal job descriptions for all machine-accounting units of this nation-wide operation were being developed by the home office staff.

The Office Manager is a college graduate. He received his initial training on punched-card equipment through the local IBM office. His total experience includes 10 years with this company in accounting positions. He has been the office manager for one year.

The Tabulating Supervisor is a college graduate. He received his initial training on punched-card equipment through the local IBM office. His total experience includes

one and one-half years in a city agency's machine-accounting unit and one year in his present position.

The Programmer is a high-school graduate and received her initial training on punched-card equipment through on-the-job training with this company. Her total experience includes 14 years in clerical jobs and one year in her present position.

In the Card-A-Type Operator job classification four persons are employed. These girls are high-school graduates and received their initial card-a-type training as on-the-job trainees with this company. All four were in general clerical positions prior to being promoted to their present job classifications at the time the machines were installed. One of the four has been employed for three years, one for two years, and the other two for approximately one and one-half years.

Current employment practices.--Sources of personnel:

New employees are hired at the level in which there is a need after promotion possibilities have been considered. The sources of personnel are private employment agencies, the state employment agency, and references from current employees.

Selection devices: All persons seeking employment are required to complete application blanks. The ability to follow directions in filling out the application blank is used as a success indicator. Upon completion of the blank,

an interview is conducted by the office manager. The final selection is contingent upon the approval of the division manager. A general clerical aptitude test is administered to all applicants. Previous employment and character references are investigated in the selection procedure. A physical examination is given, and any physical defect that may be aggravated by strain will eliminate an individual. This procedure is followed to comply with requirements set by the insurance company writing group coverage for this business concern.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when a vacancy occurs. Information concerning the specific salaries for the seven jobs was not reported. The office manager did state that he considered the salaries paid to be above average compared to other salaries paid in this field in Oklahoma City.

Qualifications of employees.--Personal traits: The personal traits emphasized for personnel in this unit are ability to do exacting work, adaptability, and patience.

Education: A high-school education is required for employment in the machine-accounting unit. It was recommended that a college degree be required for the office manager position and that it is preferred in the machine operator position. The machine operator should have formal education in accounting.

Typewriting ability is a necessity for the card-a-type operators. Also, the individuals in these two operative positions should attend all IBM courses applicable to the machines.

Experience: Experience on equipment is not required for employment. In this unit attempts are made to insure that the programmer has extensive experience with the company and a thorough knowledge of both manual and machine processes for the functions performed on machines.

In-service education: No planned in-service education program is in effect. The office manager does give informal instruction in card-a-type operations when needed.

Machine utilization.--Production: The machines in use and the percentages of time in operation are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch	100
Sorter	100
Collator	100
Reproducer	100
Accounting Machine	100
Card-a-type (2)	100
Desk Calculator	---

This unit operates its machine on a nine-hour day and it was emphasized that the two card-a-type machines actually are operated continuously by having the four operators in the unit. The other machines are operated as much as is humanly possible, to keep all machines running nearly 100 per cent of the time. The IBM machines are rented at \$2,000 monthly.

Time and cost savings: A significant saving of time was indicated in statements of the office manager. However, there has been no study to establish dollar amounts or percentage figures. It was emphasized that reports with more information are available much more quickly.

Accuracy factor: There are no records to indicate whether there has been a significant improvement in accuracy. However, based on the statement that "more errors on some operations, less on others," it appears that this company is not experiencing increased accuracy as normally expected. It was pointed out that some of the errors can be contributed to carelessness on the part of the present operators, in that they do not pay enough attention to details.

Unique problems.--From the standpoint of management, there are no problems involving personnel that might be directly chargeable to machine operations. The office manager indicated that the main problem in this unit is organizational. As previously stated, the use of equipment for all district offices is established by the home office, based on volume of sales. In this district the sales volume is at the top of the bracket for the machines authorized, causing a definite operational problem.

Wholesale Distribution

This case pertains to the operations of a local auto parts wholesale distribution company. The company was organized in 1934 and its activities are confined to the western half of the state of Oklahoma. A franchise is held for exclusive distribution of auto parts produced by one of the major automobile producers in the United States. The gross sales volume is approximately \$1,500,000 per year.

The average number of employees is 35. Of this number nine are engaged in clerical and accounting jobs, and the remaining 26 are engaged in distributive phases of the total operation.

The organizational structure places responsibility for all operations with the President. The machine-accounting unit has no specific title, machines and personnel are considered as part of the general office operation. The present card-a-type machine operation has been in effect approximately six years. Machines were first installed to fulfill the billing function. Of the nine employees in clerical and accounting jobs within the company, two are employed as card-a-type operators.

Machine accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. Machine utilization is comparatively limited, and at no time has a

machine ever replaced an employee. In the six years the card-a-type machines have been in operation, the number of operators has never exceeded two. In the opinion of the president the two persons currently employed constitute an adequate staff for present operations except for approximately an hour of overtime required of one operator each day. This overtime is necessary because large quantities of orders arrive in the late afternoon. It was estimated by the president that only one additional person would be required to do manually what is currently done by machine. It was pointed out that the card-a-type operators perform other office duties, therefore, it is impractical to re-schedule work to eliminate any overtime operation. This machine operation also jobs out its card punching to a contract office. The basic reason for machine utilization was to attain a high degree of accuracy not attainable by manual methods. It was reported that actually one machine would be adequate for normal operations, but the extra machine was required to allow for machine failure.

Specific accounting functions.--The functions of this machine-accounting operation have been limited to those that were initially started at the time of machine installation--billing and invoicing. It is anticipated that all accounting will be added to these functions. In making this change, new equipment will be installed, the "50 series" of IBM

punched-card machines. This equipment operates as the regular punched-card equipment, but at slower speeds. The rental is approximately one half the cost of equipment found in present IBM installations.

Machine accounting personnel.--The two employees that constitute the present personnel have job titles although no attempt has been made to formalize descriptions of their jobs.

In the Card-A-Type Operator job classification two individuals are employed. Both women are high-school graduates and received initial training on card-a-type operations by means of on-the-job training with this company. Both had previous experience as general clerical workers. One of the women has been employed for two years, the other two months.

Current employment practices.--Sources of personnel: New employees are hired at the job levels in which there is need. The sources of personnel are both private and state employment offices.

Selection devices: All persons who seek employment are required to complete application blanks. They are then interviewed by the president who makes the final selection. Previous employment and character references are used in the selection procedure.

Promotion and salaries: Because of the nature of this operation there are no promotions. Information concerning the specific salaries for the two jobs in this unit was not

reported. The president did indicate the range to be from \$200 to \$240. This indicates that probably the salaries paid are about average as compared with salaries of key-punch operators.

Qualifications of employees.--Personal traits: The personal traits emphasized for personnel of this unit are physical stamina, ability to work under pressure, ability to work accurately, and an even temperament.

Education: A high-school education is required for employment. Typewriting ability is a necessity with training in accounting recommended. The typewriting speed desired is 30 words per minute. No special machine preparation is required other than through on-the-job instruction.

Experience: Experience on equipment is not required for employment. It was emphasized that persons who have had manual posting-machine experience, preferably accounts receivable, make good card-a-type operators.

In-service education: This company has no planned in-service education program. The senior operator trains new personnel as they begin their work.

Machine utilization.--Production: This company has two IBM Card-A-Type machines. No operational record is kept, however, an attempt to keep one machine in operation throughout each eight-hour working day is exerted. These IBM machines are rented for a monthly fee of \$1,000.

Case No. 13

Time and cost savings: No real saving is experienced by this company because of the utilization of the two machines. It was pointed out that by contracting the card punching, a one-half time key-punch operator is not required.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. However, a statement from the president indicated that accuracy was the basic reason for machine utilization and that prior to the installation of the card-a-type machines errors were "notorious."

Unique problems.--The president said that the main problem encountered in changing from "pen-and-ink" methods to machine methods was the payment of a bonus in one machine rental. This it is hoped will be overcome by the anticipated change to regular punched-card equipment which will allow for more flexibility in the operation and a reduction in cost.

Case No. 14

Wholesale Distribution

This case pertains to the operations of the home office of a wholesale grocery company. The company was organized in 1918 and its activities are confined to central and western Oklahoma and southwestern Kansas. Prior to 1918 the owners of this concern operated a retail grocery store for five to six years. The annual sales volume is between

\$9,000,000 and \$10,000,000. There is a branch office and warehouse located in Tulsa, Oklahoma.

The average number of clerical and accounting employees is 17. Of these 17, six are employed in the machine unit--one Supervisor, two Machine Operators, two Key-Punch Operators, and one Clerk.

The organizational structure places responsibility for the operation of the unit with the President; a Supervisor is in direct charge of the unit. The unit is called the "IBM Department." The present unit has been in operation approximately 11 years. Machines were first installed to fulfill the invoicing and stock-control functions.

Machine-accounting operation.--There has been a net decrease of five in the number of employees engaged in clerical and accounting jobs throughout this company due to the use of machines. However, at no time has a machine ever actually caused an employee to be discharged. By not replacing individuals who left employment in the normal flux of jobs has resulted in the decrease. In the 11 years machines have been utilized, the number of employees has never exceeded 6. In the opinion of the Supervisor, the 6 persons currently employed constitute an adequate staff for present operations. It was emphasized that this company could not do manually what is currently done by machines. No estimate was given concerning even an approximation of the persons that would

be needed to process manually the information processed by machines. There are peak load periods three times a week. The punched-card equipment processes these peak loads without any overtime requirement. Through the use of punched-card methods the local management now receives reports of value that were not even envisioned when manual methods were in use.

Specific accounting functions.--The functions of this unit at the time of installation of machines were preparation of invoices and inventory control. The functions currently include sales analysis, billing of accounts receivable, recording of accounts payable, expense distribution, and general ledger accounting. It was emphasized that all these functions were added when it was determined that the work could be accomplished more rapidly and with less expense than by other means. At the same time the functions were added, it was possible to transfer all individuals whose specific jobs were eliminated to other departments because of the reduced manual effort required.

At the present time, it is anticipated that an IBM "305 RAMAC" will be added to the operation of this unit to take over the functions currently processed by regular punched-card equipment. This equipment change will allow for processing extensive detail, that is not practical to process now even though this company is highly mechanized.

It is thought that normal attrition will allow for any shifting of jobs, making it unnecessary to discharge any clerical or accounting people.

Machine accounting personnel.--The six employees in this machine unit have specific job titles although no effort has been made to formalize the job descriptions.

The Supervisor is a high-school graduate and received his initial machine preparation by means of on-the-job training with the company. His total experience includes 21 years as traffic manager and eight years in his present position, which entails both supervision and the other administrative duties.

In the Machine Operator job classification two men are employed. Both are high-school graduates and received initial training on punched-card equipment while on the job. Both of these men were promoted from warehouse jobs. One has been in his present position for three years, the other for six months. Both have been in the employ of this company approximately six years.

In the Key-Punch Operator job classification two women are employed. Both are high-school graduates and received their initial key-punch training on the job--one with this company, the other in another business concern. One woman has been employed for six years, the other has been with the company for only one year.

The Clerk is a high-school graduate. She is being trained by the company for work as a key-punch operator. Her total work experience is the several months in her present position.

Current employment practices.--Sources of personnel: New employees are hired at the job level in which there is a need after promotion has been considered. The main source of personnel for this IBM Department is the company itself.

Selection devices: All persons seeking employment are required to fill out application blanks. Employment interviews are conducted by the personnel manager. The final selection of an individual for the machine unit is contingent upon the approval of the Supervisor. A general aptitude test is administered to all new employees by the personnel department. References from any source are very seldom used in the selection procedure of this company.

Promotion and salaries: Promotion is primarily from within and individuals are up-graded if possible when vacancies occur. Information concerning specific salaries for the six jobs in the machine-accounting unit was not provided. The Supervisor did indicate that the salaries of the Machine Operators, Key-Punch Operators, and the Clerk, ranged from \$250 to \$400 per month. No information relative to the Supervisor's salary was stated because of company policy. The range in salaries reported indicates that probably the

actual salaries paid are above average as compared with the salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: No specific personal trait was emphasized for people in this department.

Education: A high-school education is required for employment. Formal education in accounting and mathematics is recommended for supervisors of machine-accounting units. No special machine preparation is required. It was emphasized that special machine instruction is of value after some experience in the actual operation of punched-card equipment has been gained.

Experience: Experience on punched-card equipment is not required for initial employment. In this concern, attempts are made to insure that all employees have had some grocery experience, either in other departments of the company or in retail grocery outlets.

In-service education: This company's in-service education program consists of company contributions for self-improvement, and allowing company time for instruction in machine operation through the local IBM courses.

Machine utilization.--Production: The machines in use are: two Card-Punches, one Sorter, one Collator, two Accounting Machines, one Reproducer, one Adding-Listing Machine, and one desk-type Calculator. This company attempts

to operate the punched-card machines continuously for each eight-hour day. The IBM machines are rented for a monthly fee of \$1,260.

Time and cost savings: A significant saving of time was emphasized by the following comment: "Manually it took 15 to 20 days to compute the profit from operations. With machines we operate on a day-to-day closing, with the profit for each day available one to two hours after the closing time, noon each day." It was pointed out that the per unit cost in preparation of an invoice or writing a check has increased, but the increased information available has more than offset this rise in cost.

Accuracy factor: There are no records kept to indicate whether there is improvement in accuracy. However, increased accuracy is indicated in the statement of the Supervisor that "there was no manual proof other than another manual operation. There is no guess work on machines, whereas we were never sure on manually-processed data." This statement indicates that the machine operations tend to be free of errors.

Unique problems.--The Supervisor indicated that the main problem encountered in changing from manual methods to machine methods was the fear of loss of jobs as evidenced by the accounting and clerical personnel. This was overcome by announcements to the employees of information in relation to

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the change-over, well in advance of the actual change. It was dramatically stated that "such a change is the greatest shock an organization ever goes through."

Case No. 15

Wholesale Distribution

This case pertains to the operation of the general office of a wholesale grocery company that is a division of a nation-wide grocery organization. The company was organized in 1931 and its early activities were confined to central Oklahoma. In 1956 this concern became a division of the nation-wide organization. The division warehouse and general office distributes a standard line of products found in the modern super-market. At the present time 36 stores in Oklahoma and two in Texas are serviced from the Oklahoma City center. The annual sales volume is approximately \$36,000,000.

The average number of employees in this company is 225. Of this number, 60 are engaged in clerical and accounting work, and the remaining 165 employees are engaged in distributive phases of the total operation. The organizational structure places responsibility for the operation of the machine-accounting unit with the controller, a supervisor is in direct charge of the unit. The unit is called the "IBM Department." The department has been in operation approximately two years. Machines were first installed for billing.

Of the 60 employees in clerical and accounting jobs, 10 are employed in the IBM Department--one Supervisor, one Chief Machine Operator, three Machine Operators, four Key-Punch Operators, and one Control Clerk.

Machine-accounting operation.--There has been little or no variation in the number of employees in clerical and accounting jobs due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the two years the unit has been in operation, the number of employees has never exceeded 10. In the opinion of the supervisor a key-punch operator should be added, for the unit to be adequately staffed. Part-time workers are now required to complete certain of the operations of this machine-accounting unit.

In this wholesale grocery company, physical inventory constitutes the peak-load operation. Prior to machine utilization, this took 18 to 20 hours with eight to ten people working overtime, and is now accomplished in 10 hours with no overtime. The machines are operated on a 12-hour basis, a regular eight-hour day plus a four-hour night shift of part-time employees. Through the use of punched-card methods, the company has been able to expand without increasing data-processing costs.

Specific accounting functions.--The function of this unit at the time of installation was largely that of store billing. The functions have been expanded to currently include: sales analysis, subsidiary general ledger accounting, preparation of the payroll, store accounting, and inventory control. These functions were added when it was determined that the work could be accomplished more rapidly and with less expense than by other means. At the time the unit took over these functions, it was possible to absorb all people directly affected by the change in other work in the same department. Machines reduced the manual effort required so that individuals could utilize their time in performing work requiring decisions or interpretation. The adding of inventory control caused a need for additional personnel. Such people were not available, therefore a 12-hour day was initiated for machine operations and a part-time machine operator was added to the staff.

At the present time, it is anticipated that the IBM "305 RAMAC" will be installed to process the same functions plus others as the operation of this new machine becomes stable. In adding this machine it will be possible to return to the eight-hour day and decrease the number of employees in the machine-accounting unit by three key-punch operators and one machine operator. These individuals will be given an opportunity to transfer into other departments of the business.

Machine-accounting personnel.--The 10 employees that constitute the personnel of this department have specified job titles although no attempt has been made to formalize job descriptions.

The Supervisor is a high-school graduate and has attended college, mainly extension work. He received his initial punched-card equipment training on the job in other business concerns. He has had extensive experience in punched-card accounting, coming to this company with 18 years of operative and supervisory experience. He has been in his present position two years.

The Chief Operator is a high-school graduate and received his initial training on the job with this company. He was employed as a trainee and has been promoted through the Machine Operator job classification to his present position. He has been an employee for two years.

In the Machine Operator job classification three men are employed, two full-time and one part-time. All of these men are high-school graduates and one has had one year of college. The full-time machine operators both had approximately three years of experience on punched-card equipment at the time of employment. One received his initial training through the local IBM office the other two through on-the-job training. The full-time operators have been employed for one year. The part-time man has been employed less than a year.

In the Key-Punch Operator job classification four women are employed, two full-time and two part-time. All are high-school graduates. Three received their initial key-punch training through the local IBM office the other through a local business college. All four of these individuals were experienced operators and have been employed less than one year.

The Control Clerk is a high-school graduate and received her key-punch training at the local IBM office. This person was promoted from general clerical positions, to key-punch operator, to control clerk. She has been an employee for 13 years and has been in her present position for eight months.

Current employment practices.--Sources of personnel:

New employees are hired for office jobs at the levels in which there is need. The sources of personnel for this unit are the local IBM office, classified advertising, and contacts with other supervisors of machine-accounting units.

Selection devices: All persons seeking employment fill out application blanks and are interviewed by persons in the personnel department. The final selection of people for the machine unit is contingent upon the approval of the supervisor. The Wonderlich Aptitude Test is administered to all applicants. Character references are used in the selection procedure.

Promotion and salaries: Promotion is primarily from within. Information concerning specific salaries for the 10 jobs in the unit was not available. The Supervisor did indicate the average weekly salaries in four of the positions: Chief Operator \$90, Machine Operator \$75, Key-Punch Operator \$55, and Control Clerk \$60. No information relative to the supervisor's salary was stated because of company policy. The average salaries reported are near average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized are ability to withstand monotony, ability and desire to learn, ability to concentrate, ability to make decisions quickly, and manual dexterity. The supervisor indicated that the ability to get along with people is a very necessary trait for an individual in the control clerk position.

Education: A high-school education is required for employment. Typewriting ability is a necessity for the key-punch operators with training in accounting desired for machine operators. Special machine preparation recommended for machine operators is the basic machine and functional wiring preparation offered by the local IBM office. The key-punch course is considered a requirement for employment in key-punch operator positions.

Experience: Experience on equipment is required for employment. Attempts are made to employ individuals as key-punch operators and machine operators with as much punched-card machine experience as possible. An individual to fill the position of supervisor should have from four to five years of machine-accounting experience.

In-service education: This company has no planned in-service education program. Specific job instruction is the general extent of in-service education. Occasionally employees are sent to the local IBM office if a need arises and an appropriate course is offered.

Machine utilization.--Production: The machines in use and the percentages of time in operation where known are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (5)	85
Verifier	50
Sorter (2)	75
Collator (2)	75
Accounting Machine	75
Reproducer (2)	75
Calculator	75

These IBM machines are rented for a monthly fee of \$2,300.

Time and cost savings: A significant saving of time was indicated in a statement from the supervisor. However, there are no specific data to indicate dollar amounts or percentage figures. It is estimated that \$5,000 has been saved through use of machines in taking physical inventory.

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Accuracy factor: There are no records kept to indicate whether there has been significant improvement in accuracy. However, it was emphasized by the supervisor that through machine utilization checks built into the system allow for a constant control of accuracy.

Unique problems.--The supervisor indicated that the main problem encountered in changing from manual methods to machine methods was education of the general office and the store personnel in the use of order procedures based on punched-card accounting methods. This was overcome by repeatedly giving specific instructions to the employees in regard to the change-over in methods.

Case No. 16

Manufacturing

This case pertains to the operations of the home office of an oil-field equipment-manufacturing company that is a subsidiary of a holding company. The subsidiary company was organized in 1923 and its early activities were confined to oil-field repair work in Oklahoma, Kansas, Texas, Illinois, and Louisiana. In 1944 all of its repair shops were sold and the company concentrated on manufacturing activities in one central location, Oklahoma City. The original company was purchased by the holding company in 1955, and has since functioned as a subsidiary.

The equipment manufactured is a standard line of drilling and production products, such as slush pump valves and seats, drill collars, Kellys, Catheads, fishing tools, packers, and many other rotary-drilling and production tools. The distribution of this oil-field equipment is world-wide through various oil-field equipment-supply companies. The sales volume is between \$9,000,000 and \$10,000,000 per year.

There is a branch sales office located in Canada and the over-seas office is in New York City. General accounting policies are formulated by the subsidiary company but are subject to approval by the parent company.

The average number of employees is 425. Of this number, 240 are employed in the manufacturing plant, 25 are engaged in clerical and accounting jobs, and the remaining 160 employees are engaged in the distributive phases of the total operation.

The organizational structure places responsibility for the operation of the machine-accounting unit with the secretary-treasurer--a supervisor is in direct charge. The unit is called the "Machine Accounting Division," referred to informally as the "IBM Department." This unit has been in operation approximately 12 years. Machines were first installed to fulfill the cost-accounting function. During the year 1945, the facilities of the local IBM Service Bureau were used to process the cost data. In 1946, the actual

installation of IBM machines was accomplished and various component machines have been added until now the unit is equipped with seven tabulating and accounting machines.

Of the 25 employees in clerical and accounting jobs, four are employed in the machine-accounting division: the Supervisor, Key-Punch Operator, Machine Operator, and Clerk. The latter individual is a cost-accounting clerk and a machine trainee.

Machine-accounting functions.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the 12 years the machine-accounting division has been in operation, the number of employees has never exceeded five. The supervisor stated that the four persons currently employed constitute an adequate staff for present operations except for ten hours of overtime required of the machine operator in the preparation of monthly reports for the parent company. The supervisor estimated that 12 additional persons would be required to do manually what is currently done by machines.

Closing of books and the preparation of financial reports must be accomplished within eight days after the close of each accounting period. It is the consensus of

personnel in the machine-accounting division that this would be a monumental task if the accounting machines were not available. The preparation of these reports necessitates ten hours of overtime each month, even with the use of machines. Prior to 1955, operations were limited in scope and the accounting personnel encountered no problems in meeting deadlines; consequently no overtime was necessary.

Through the use of punched-card methods, the local management now receives reports of value that were not even envisioned when manual methods were in use.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was largely that of cost accounting. The expanded functions currently include: sales analysis, billing of accounts receivable, preparation of the payroll, a company mailing list, current employment histories, and the monthly report to the parent company.

The billing of accounts receivable became an added function when it was determined that the work could be accomplished more rapidly and with less expense than by other means. At the same time the machine-accounting division took over this function, it was possible to transfer one accounts-receivable clerk to another department within the company because of the reduced manual effort required. Preparation of the payroll became a function of the division when it

became apparent that the extensive clerical burden in the manual preparation of the payroll could be drastically reduced with the machines already available. The assumption of the payroll function resulted in an immediate saving in both time and salary expended. One payroll clerk was re-located within the company to perform duties for which he was qualified. In connection with the preparation of the payroll records, the machines are used to prepare W-2 forms, insurance records, and State and Federal reports.

Monthly reports were required after consolidation with the parent company. Since the accounting methods were handled with machines, this new function resulted in no need for added personnel. Preparation of mailing lists and the development of employment histories are additional functions instigated by the supervisor of the division as a service to all employees.

It is anticipated that inventory control and accounting for fixed assets will be added to the functions of this division. In adding inventory control, it is thought that one or two stock-record clerks in the stock-records department will be eliminated. These persons will be re-located in other jobs in the company according to their qualifications. This anticipated change will fit naturally into the present cost-accounting function.

Machine-accounting personnel.--The four employees that constitute the personnel of this division have specific job titles but no job descriptions have been formalized.

The Division Supervisor is responsible for the fulfillment of the functions of this unit. He has been employed by the company for 20 years and has been the supervisor of the machine-accounting unit from its beginning. This person was initially employed as a timekeeper and was promoted through the accounting department to supervisor of the cost-accounting department before taking over as supervisor of the machine-accounting division. He is a high-school graduate and has attended business college. His knowledge of punched-card equipment was obtained on the job and through evening classes conducted by the local IBM district office.

The Machine Operator is a high-school graduate. His source of initial preparation was on-the-job training while employed by the Oklahoma City Air Materiel Area at Tinker Air Force Base. His total experience includes several years in public accounting, one and one-half years of punched-card experience in the installation at Tinker Field, and eight months in his present position.

The Key-Punch Operator is a high-school graduate and received her training on the job in another business concern. She was experienced when employed, was hired as a key-punch operator and has been with the company for one year.

The Cost-Accounting Clerk is completing work for a bachelor's degree in accounting. He was hired on a part-time basis as a trainee for management. He had no previous employment experience other than the clerical work he performed prior to getting into his present classification. This individual has been with the subsidiary company for four years and has been a machine trainee for two years.

Current employment practices.--Sources of personnel: New employees are hired at the job levels in which there is need. The sources of personnel are the local IBM office and the Oklahoma State Employment Service.

Selection devices: All persons are required to fill out application blanks. Interviews are conducted by the secretary-treasurer. The final selection of an individual is contingent upon the approval of the division supervisor. The IBM key-punch aptitude tests are used. The applicants are sent to the local IBM office for testing. References from previous employment are used in the selection procedure for each individual seeking employment. An extensive physical examination is given. Any physical defect that would eliminate an applicant from plant employment will also eliminate him from an office job. This procedure is followed to comply with requirements set by the insurance company that writes group coverage on the employees.

Promotion and salaries: Promotion is primarily from within, and an individual is up-graded if possible when a vacancy occurs. Information concerning the specific salaries for the four jobs in this unit was not made available. The supervisor did indicate the range of salaries in three of the positions--Machine Operator, \$234 to \$359; Key-Punch Operator, \$212 to \$325; and Clerk (machine trainee), \$195 to \$295. No information relative to the supervisor's salary was given because of company policy. The range in salaries reported indicates that probably the actual salaries paid are above those revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized for personnel of this division are ability to reason, manual dexterity, mechanical aptitude, and ability to withstand monotony. It is also required that employees have at least average intelligence. The supervisor indicated that in many cases the "high-strung" individual makes a good punched-card machine operator.

Education: A high-school education is required for employment. Typewriting ability is a necessity for the key-punch operators with training in accounting desired for machine operators. No special machine preparation is required other than experience on the equipment.

Experience: Experience on equipment is required for employment. Attempts are made to insure that key-punch

operators have at least one year of experience, and machine operators two years of experience, prior to employment.

In-service education: This company has no in-service education program. Evening programs of instruction conducted by the local office of IBM have been utilized.

Machine utilization.--Production: The machines in use and the percentages of time in operation where known are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch	50
Verifier	50
Sorter	--
Collator	--
Accounting Machine	75
Reproducer	--
Multiplier	--
Adding Listing (2)	--
Desk-Type Calculator	--

This company also has an IBM Card-A-Type machine located in the billing division for use in preparing invoices. The IBM machines are rented for a monthly fee of approximately \$1,000 for the machine-accounting division and \$500 for the billing division.

Time and cost savings: A significant saving of time was indicated in a statement from the supervisor. However, there has been no study to establish definite dollar amounts or percentage figures.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in

accuracy. Based on the statement that follows, it is assumed that increased accuracy has resulted in definite savings for this company. The supervisor said: "Since machine installation was effected, there has been a decrease in the number of credit memos issued because of errors in pricing and in extensions. The internal auditors more readily accept accounting information without a thorough check. Because of machine operations, each source department has more time to check original documents for errors before they are processed."

Unique problems.--The supervisor indicated that the main problem encountered in changing from manual methods to machine methods was the fear of loss of jobs on the part of accounting and clerical personnel. This was overcome by announcements to the employees of information in relation to the change-over well in advance of the actual change. This procedure aided in making the change a natural transition.

From the standpoint of management, there were no problems involving personnel that might be directly chargeable to machine processes. Because of the size of the office staff, no extensive training problems were involved. Normal attrition has made unnecessary any special provisions for persons temporarily not required during the change-over period.

Manufacturing

This case pertains to the operations of a local candy company that makes and distributes bulk and packaged candies. The company was organized in 1932 and its products are distributed throughout the United States. The company's sales volume was not reported. The average number of employees of the company is 190; however, due to the seasonal nature of its products, this number is doubled in the fall with the addition of production and distribution workers in the plant and shipping room. Of the 190, 155 are employed in the processing plant and shipping room, 15 are engaged in clerical and accounting jobs, and the remaining 20 employees are engaged in the selling phases of the total operation.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Office Manager--a department head is in direct charge of the unit and the total accounting operation. The unit is called the "IBM Department" and is a part of the accounting department. The present machine-accounting unit has been in operation for four years. Machines were first installed to fulfill accounts-receivable billing functions.

Of the 15 employees in clerical and accounting jobs, four are employed in the machine-accounting department--one Department Head, two general Machine Operators, and one Key-Punch Operator. The Key-Punch Operator is also the payroll

clerk. One of the general machine operator's duties includes operating a key-punch machine.

Machine-accounting operation.--There has been a decrease of three in the number of employees engaged in clerical and accounting jobs due to the use of machines. This decrease was resolved through normal attrition. At no time has a machine ever caused an employee to be discharged. In the four years the machine-accounting unit has been in operation, the number of employees has never exceeded four. In the opinion of the department head, the four persons currently employed constitute an adequate staff for present operations. The use of machines has continuously expanded the amount of work accomplished. It was estimated that ten additional persons would be required to do manually what is currently done by machines.

In this candy company, due to the seasonal nature of its production, a peak in accounting operations also occurs. Through the utilization of machines, overtime operations experienced with manual methods has been decreased to a very limited number of hours per week and then only occasionally. During normal operational periods, prior to machine utilization, occasional overtime existed throughout the month. This overtime was completely eliminated by machine procedures.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was

billing accounts receivable. The functions have been expanded to currently include sales analysis and preparation of the payroll. Sales analysis became an added function as a by-product of billing of accounts receivable. Prior to machine utilization cumulative general sales reports were prepared by hand. The persons who were relieved of this detail now perform other duties of a higher degree of clerical skill. Preparation of the payroll became a function of the unit when it became apparent that the extensive clerical detail in the manual preparation could be drastically reduced with the machines available. The payroll clerk was re-located in the IBM Department, performing the duties of payroll clerk plus the operation of a key-punch machine. In connection with the preparation of the payroll records, the machines are used to prepare W-2 forms, insurance records, and State and Federal reports. At the present time, there are no anticipated additions to the functions of this department.

Machine-accounting personnel.--The four employees who constitute the personnel of this department have specific job titles, although no attempt has been made to formalize job descriptions in the IBM Department.

The Department Head has been employed by the company for 12 years and has been head of the machine-accounting department from its beginning. This person was initially employed as a bookkeeper and was promoted through the accounting

department to head of the department before assuming the added responsibility of the machine-accounting installation. He is a high-school graduate and has attended business college. His knowledge of punched-card equipment was obtained on the job and through evening classes conducted by the local IBM district office.

In the General Machine Operator job classification two persons are employed. Both are high-school graduates, one has completed one year of college. These two persons received their initial key-punch training on the job, one with this company the other with another company. One of these two women has been employed for 13 months the other six months. The latter individual was an experienced key-punch operator at the time of employment.

The Key-punch Operator is a high-school graduate. Her source of initial training was on the job with this company. Her total experience includes several years in accounting-clerical work prior to employment with this company, eight years as payroll clerk and four years as Key-punch Operator.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need. The sources of personnel are both state and private employment services.

Selection devices: All persons who seek employment are required to fill out an application blank containing general information. An interview is conducted by the personnel manager who also makes the final selection. References from previous employment are requested and checked. This is the extent of the selection devices used by this company.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when vacancies occur. Information concerning the salaries for the four jobs was not reported.

Qualifications of employees.--Personal traits: The personal traits for personnel of this department were considered to be no different from the normal employable traits expected of any individual seeking office employment.

Education: A high-school education is required for employment. A knowledge of accounting is a necessity for the head of the department; special machine preparation should include instruction on the accounting machines used. All other employees in the machine unit should attend the key-punch operators school conducted by the local IBM office. It is also recommended that one general machine operator should have completed the basic wiring course conducted by the IBM school.

Experience: Experience on equipment is not required. In this company, a person might be employed even in the position

of machine operator with only key-punch experience or no experience whatsoever with punched-card equipment.

In-service education: This company has no planned in-service education program. If possible and when an occasion arises, employees are sent to programs of instruction conducted by the local IBM office.

Machine utilization.--Production: The machines in use are: two Card Punches, one Sorter, one Accounting, one Reproducer, one Adding-listing, and one Typewriter. The IBM machines are rented for a monthly fee of \$560.

Time and cost savings: A significant saving of time was indicated in a statement from the department head. However, there has been no study to establish definite dollar amounts or percentage figures. Even though there was an overall savings resulting from the time involved in preparation of data for management, a definite increase in salaries was experienced due to the higher degree of skill required of machine-accounting personnel.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. The department head stated however, that increased accuracy has resulted in savings for this company.

Unique problems.--From the standpoint of management, there were no problems involving personnel that might be directly chargeable to machine processes. Normal attrition

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has made unnecessary any special provision for persons temporarily not needed during the change-over period. It was indicated by the head of the machine-accounting unit that employees welcomed the machines as they released them from the excessive clerical detail required of manual methods.

Case No. 18

Manufacturing

This case pertains to the operations of an aircraft manufacturing and distributing company. This company was organized in 1951. Its brief history includes a disastrous fire that destroyed much of their production equipment. At the time of this case write-up, the operations of this aircraft manufacturing company had relocated in a new building, housing the general offices and production facilities. The company manufactures executive-type aircraft which are distributed through sales agents on a world-wide basis.

The average number of employees is 850. Of this number, 350 are employed in the Production Division, 50 in the Engineering Division, 15 in the Purchasing Division, 35 in the Sales Division, and 25 in the Accounting Division. A total of approximately 50 persons are engaged in accounting and clerical jobs.

The organizational structure places responsibility for the operation of the machine-accounting unit with the

Comptroller; a Supervisor is in direct charge of the unit. The unit is called the "IBM Tabulating Department" and is a part of the Accounting Division. The present IBM Department started operations in April, 1958. Machines were first assigned to payroll and labor distribution. This case write-up is unique because it involves a change from Remington-Rand equipment to IBM equipment. Labor distribution had been performed on the Remington-Rand punched-card equipment. The payroll was programmed for machine procedures at the time of installation of IBM equipment.

Of the 50 persons in clerical and accounting jobs, five are employed in the machine-accounting department--one supervisor, one machine operator, two key-punch operators, and one verifier operator.

Machine-accounting operation.--There has been a steady increase in the number of employees engaged in clerical and accounting jobs due to an increased volume of business conducted by this company. The use of machines has aided in the amount of work accomplished, but at no time has a machine ever replaced an employee. In the short time the machine-accounting department has been in operation, the number of employees has increased from three to five. In the opinion of the supervisor, the five persons currently employed constitute an adequate staff for present operations except for several hours of overtime required in the closing

procedure at the end of each month and year. Because of the short length of time this unit has been in operation, the supervisor indicated that he would not be able to venture a guess on the number of additional persons that would be required to do manually what is done on machines.

Specific accounting functions.--The functions of this IBM Department at the time of installation were preparation of payroll and labor distribution. The functions have been expanded currently to include perpetual inventory of all production materials. When the machine-accounting department took over the function of payroll preparation it was possible to eliminate two payroll clerks because of the reduced manual effort required. One of these individuals was relocated within the company to perform duties for which she was qualified. The other person was on a leave at the time of the conversion and did not desire to return. Machine utilization in the payroll function resulted in an immediate saving in both time and salary expended. In connection with the preparation of payroll records, the machines are used to prepare W-2 forms, insurance records, and State and Federal reports.

Perpetual inventory was added to provide for better inventory control, made possible because of the speed and accuracy of punched-card equipment. It is thought that, after this procedure is completely under machine control, two stock

records clerk jobs will be eliminated. The individuals in these jobs will be re-located; however, one of the two has been planning to resign.

It is anticipated that Accounts Payable will be added as the preliminary step to check writing. When check writing is added to the functions of this unit, one Accounts Payable Clerk will be re-located in another position for which she is qualified. These functions are to be added because of the speed and accuracy of machine processing.

Machine-accounting personnel.--The five employees who constitute the personnel of this department have specific job titles, although no attempt has been made to formalize job descriptions.

The Department Supervisor is a high-school graduate and completed a business college program in accounting. He received his initial training on punched-card equipment through on-the-job training while employed with Lockheed Aircraft Corporation. His total experience includes 18 years in punched-card installations in Oklahoma City. He had helped to install and had supervised several other IBM installations prior to his employment with this company. He has been employed by this company six months.

The Machine Operator is a high-school graduate. His source of initial training was on-the-job training while employed with Boeing Aircraft Company of Wichita, Kansas. His

total experience includes several years with this company in the Production Division, one year of punched-card experience at Boeing, and two months in his present position.

In the Key-Punch Operator job classification two women are employed. Both are high-school graduates and received their initial key-punch instruction as on-the-job training, one with this company the other through a state agency. One of these two women was employed for five years by this company as a machine operator on Remington-Rand equipment. She has been in her present position six months. The other person had several months experience in the Oklahoma Tax Commission during tax season and has been employed in her present position for two months.

The Verifier Operator is a high-school graduate and received her initial key-punch training on the job in another business concern. She had five years' experience as a key-punch operator at the time she was employed. She was hired as a verifier operator and has been employed for three months.

Current employment practice.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need. The source of personnel for this unit is the local IBM office.

All persons who seek employment are required to fill out an application blank containing general information. A

brief interview is conducted by the personnel manager, after which the supervisor of the IBM Department conducts a more thorough interview. The final selection of an individual for this department is contingent upon the agreement between the personnel manager and the supervisor. A general aptitude test is administered in the personnel department. Both previous employment and character references are used in the selection procedure. No physical examination is required; however, physical defects that would eliminate an applicant from employment are loss of sight and inability to use their arms.

Promotion and salaries: At the time this case-report was made, promotion was impossible because of the size of the department. When possible, promotion will be primarily from within and an individual will be up-graded when vacancies occur. Information concerning salaries for the five jobs in the machine-accounting unit was not stated. The supervisor did indicate that the salaries in the department were near the average salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal trait emphasized was patience. It was also indicated that machine personnel should like this type of work very much to be able to succeed in it. For the position of Supervisor it was emphasized that, along with patience, this person should not be a "high-strung" individual.

Education: A high-school education is required for employment. Typewriting ability is helpful for key-punch operators with training in accounting recommended for machine operators. Special machine preparation is recommended along with experience on punched-card equipment.

Experience: Attempts are made to insure that both key-punch and machine operators are experienced prior to employment. It was indicated that in small installations an experience requirement is hard to adhere to.

In-service education: This company has no planned in-service education program.

Machine utilization.--Production: The machines in use are two card punches, one verifier, one sorter, one collator, one accounting, one reproducer, and one interpreter. No check is being made to indicate the per cent of time in operation for any of the machines. These IBM machines are rented for a monthly fee of \$1,150.

Time and cost savings: A significant saving of time was indicated in a statement from the supervisor. There has been no study to establish definite dollar amounts or percentage figures.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. Based on the statement that follows, it is assumed however, that increased accuracy has resulted in definite

Case No. 18

savings. "Since machine application of payroll was effected, there has been a decrease in the number of complaints from employees regarding net pay calculations. Transposing of numbers has been eliminated due to the verification procedure."

Unique problems.--The supervisor indicated that the main problem encountered in changing from "pen-and-ink" methods to machine methods was a duplication of effort because management was not ready to accept the change. This is being overcome as management sees the increased amount of information available. From the standpoint of management, there were no problems involving personnel that might be directly chargeable to machine process. Because of the nature of the equipment the major problem relates to machine downtime because of variances in temperature and humidity in the machine room. This is being overcome through better air conditioning and humidity control.

Case No. 19

Manufacturing

This case pertains to the operations of a plant office of a meat-processing company. The home office of this company is in Chicago, Illinois. This local operation attained plant status in 1911 and has been one of the leading processors of meat and meat products in this area.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Controller; a Supervisor is in direct charge of the unit. The unit is called the "Data-Processing Department." The present Data-Processing Department has been in operation approximately 13 years. Machines were first installed to fulfill the sales-journalization function.

Of the employees in clerical and accounting jobs within the company, 18 are employed in the Data-Processing Department--one supervisor, one assistant supervisor, four tabulation-machine operators, and 12 key-punch operators. The latter individuals also perform general clerical duties.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to use of machines. They have continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee even though machines were originally installed to reduce the number of employees. In the 12 years the machine-accounting unit has been in operation, the number of employees has never exceeded 18. In the opinion of the supervisor, the 18 persons currently employed constitute an adequate staff for present operations. No estimate was made by the supervisor on the number of persons that would be required to do manually what is currently done by machines.

No effect on the handling of peak loads can be determined because the conditions surrounding the machine application have changed to a great extent. Much the same thing may be said for comparing overtime operations using manual and machine methods. Very little overtime has been required at any time in this data-processing unit.

Specific accounting functions.--The function of this unit at the time of its installation was sales accounting. The functions now include: billing of accounts receivable, preparation of the payroll, and writing of orders. These functions were added to sales accounting when it was determined that the work could be accomplished more rapidly and with less expense than by other means. When the functions were added, it was the intent of the company to reduce employment of routine accounting personnel. Due to increased volume of business and need for much data, this reduction in personnel did not materialize.

It is anticipated that inventory control will be added to the present functions. In adding inventory control, it is expected that the machines will do a better and more accurate job of processing the inventory but without a reduction in personnel.

Machine-accounting personnel.--The 18 employees that constitute the staff of this unit have specific job titles, but no attempt has been made to formalize job descriptions.

The present Supervisor of the Data-Processing Department was employed in the supervisory capacity from 1948 to 1953. He then spent five years in another plant in the same capacity and came back to the Oklahoma City plant in 1958. Employed by the company for a total of 22 years, he was initially hired as an accounting clerk and was promoted to Supervisor of Data-Processing. He is a high-school graduate. His knowledge of punched-card equipment was obtained on the job and through customer training courses conducted by the local IBM office.

The Assistant Supervisor is a high-school graduate. His initial preparation was gained through on-the-job training as an employee at Tinker Air Force Base. His total experience includes several years as a machine operator in the installation at Tinker Field, plus nine years as a machine operator with this company. He has been in his present position for one year.

In the Tabulating-Machine Operator job classification there are four individuals. All are high-school graduates. Two were experienced machine operators at the time of their initial employment, the others received their initial training on the job with this company. All four of these persons have been employed from eight to nine years in their present positions.

The 12 persons classified as Key-Punch Operators are high-school graduates and, with the exception of one girl, who was an experienced operator, all received their initial key-punch training on the job with this company. The 12 women have an average of eight to nine years of service with the company. In this operation, key-punch operators are also required to do general clerical tasks.

Current employment practices.--Sources of personnel: New employees are hired at the job levels in which there is immediate need. The sources of personnel for this unit are the local IBM office, state and private employment services, and other departments within the company.

Selection devices: All persons who seek employment are interviewed by the office manager and the department supervisor. The final selection of an individual for employment is contingent upon the approval of the department supervisor. References from both previous employment and persons who can evaluate character are used in the selection procedure. A physical examination is given to comply with group insurance requirements. It was stated that only major physical handicaps would eliminate an applicant from employment.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when a vacancy occurs. Information concerning the salaries for the 18 jobs in the unit was not revealed.

Qualifications of employees.--Personal traits: The personal trait emphasized for personnel in this department was mechanical aptitude. No other specific traits were indicated as being especially significant.

Education: A high-school education is required for employment in this data-processing department. No special preparation is required of machine operators or key-punch operators. It was reported that supervisory personnel should have backgrounds in mathematics. Machine operators are required to know functional wiring of the machines and IBM courses are recommended for both machine operators and key-punch operators. It is expected that supervisory people be fully acquainted with all of the machines in the installation.

Experience: Experience is not required for employment in this company. Prior to promotion to supervisory positions in the machine unit, individuals must gain several years of experience in accounting and in the various phases of the machine operation.

In-service education: This company has no planned in-service education program. When possible, individuals are sent to the local IBM office for instruction on specific machines.

Machine utilization.--Production: The machines in use are: four Card Punches, two Verifiers, three Sorters,

two Collators, two Accounting Machines, one Reproducer, one Interpreter, and one Calculator. These IBM machines are rented for a monthly fee of \$3,800. No records are kept to show percentages of operational time for the machines used.

Time and cost savings: A saving of time was indicated in a statement from the supervisor, but there have been no studies to establish dollar amounts or percentage figures. It was reported that weekly reports are now available on Monday or Tuesday compared to Thursday or Friday when manual methods were used. There has been a reduction in clerical burden through use of the punched-card machines.

Unique problems.--From the standpoint of management, there have been no problems directly chargeable to machine processes. It was pointed out that college-educated people do not want to start working in the lower-level jobs in machine units. Since experience in the units is usually required for promotion to higher-level jobs, this new field of employment is not attracting the college accounting majors.

Manufacturing

This case pertains to the operations of a plant office of a meat-processing company. The company was organized in 1916 as a small concern and has since grown to one of the leading packers and distributors of meat and meat

products in the nation. The home office is in Chicago. This plant office is one of nine subdivisions at this level of operations. Also, under the nine plants there are 60 divisions that carry out either smaller scale production or distribution of products of this company. This plant has a sales volume of approximately \$48,000,000 per year.

The average number of employees of this plant is 1,700. Of this number, approximately 1570 are employed in the production and distribution phases, and 130 are engaged in clerical and accounting jobs.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Office Manager, who is under the Comptroller; a Supervisor is in direct charge of the unit. The unit is called the "Sales Accounting Unit" at the present time. This machine-accounting unit has been in actual operation for only one month. Machines were installed to fulfill the sales accounting function. Prior to the installation of a complete unit, services of the local IBM Service Bureau were used to process the sales data.

Of the 130 employees in clerical and accounting jobs, four are employed in the machine-accounting unit--one machine operator, and three key-punch operators. In this installation there is a supervisor, but he is not considered as a part of the machine unit.

Machine-accounting operation.--There has been no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. Four individuals are employed in the machine unit. In the opinion of the supervisor, the four persons currently employed constitute an adequate staff for present operations. Because of the newness of this unit no estimate was made by the supervisor regarding the number of additional persons that would be required to do manually what is currently done by machines. He did indicate that, already, the additional information available would be impractical under manual methods. Cost would prohibit the compiling and processing the same information manually.

This machine unit was started with only a key-punch machine. The data were punched into cards and the cards were then sent to the local IBM Service Bureau for further processing. Even though this unit has been in operation for only a short period of time, through the use of punched-card methods the local management now receives reports of value that were not even envisioned when manual methods were in use.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was that of sales accounting. The functions will be expanded to include other accounting functions as this initial operation

settles into a routine, making machine time available for expansion. Sales accounting includes invoice writing, calculations of profit on each item sold, and analysis of sales by each sales route.

Machine-accounting personnel.--The four employees who constitute the personnel of this unit have specific job titles although no attempt has been made to formalize job descriptions.

The Machine Operator is a high-school graduate and at the present is attending night school working toward a college degree. He received his initial training on the job and through the local IBM schools, while employed with this company. His total experience includes approximately two years as a national cash register machine operator with this company and two months in his present position.

In the Key-Punch Operator job classification three women are employed. All three are high-school graduates and received their initial key-punch training through the local IBM school. These three women were all comptometer operators prior to being promoted into their present positions. One of the three has been employed for approximately 15 years, the other two for five years.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need. All personnel for this unit came

from within the company. The machine operator had been a posting-machine operator, the key-punch operators were comptometer operators.

Selection devices: All persons who seek employment are required to fill out an application blank containing general information. Upon completion of the application blank, an interview is conducted in the personnel office. The final selection of an individual for this unit is contingent upon the approval of the Manager of Personnel. Previous employment and character references are used in the selection procedure. An extensive physical examination is given. Agility is the one physical characteristic that was emphasized. It was pointed out by the supervisor that one key-punch operator was deaf. This person was considered to be an excellent operator.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when vacancies occur. Information concerning the salaries for the two jobs in the machine-accounting unit was not reported. As yet no salary scale has been set for persons employed as machine operators or key-punch operators.

Qualifications of employees.--Personal traits: Normal employable personal traits were emphasized for key-punch personnel. The supervisor indicated that the mechanically inclined individual makes a good machine operator.

Education: A high-school education is required for employment. A general high-school program was emphasized for key-punch operators with instruction in accounting recommended for machine operators. Special machine preparation recommended included basic machine courses for machine operators and the IBM key-punch course for key-punch operators.

Experience: Experience is not a factor of consideration in this case. All individuals employed as punched-card machine operators come from within the company.

In-service education: This company has no planned in-service education program. Prior to the time of installation of machines, the employees who were to operate the unit were sent to the local IBM office for instruction on the machines.

Machine utilization.--Production: The machines in use are three card punches, one sorter, one collator, one accounting, one reproducer, and one calculator. These IBM machines are rented for a monthly fee of approximately \$1,000. No information was available on per cent of time in operations on any of the machines because of the relative newness of the unit.

Time and cost savings: This machine-accounting unit has not been in operation long enough to experience any saving that is noticeable.

Case No. 20

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy in the short time this unit has been in operation. However, the supervisor did indicate that there was "good" accuracy in the machine operation.

Unique problems.--The supervisor indicated that there were no specific problems encountered in changing to punched-card methods up to this point. Problems encountered establishing procedures and checking out equipment were considered normal.

Case No. 21

Manufacturing

This case pertains to the operations of a plant office of a national manufacturing company. The plant operation was started in 1957 in Oklahoma City and its early activities were confined to training new employees in a pilot-plant operation. In the organizational structure a plant is the second largest production unit; works are above the plant level and satellite locations and shops are below the plant level. The equipment manufactured is a special line of communications equipment that is used extensively in central offices of telephone systems. The distribution of this communications equipment is world-wide through a distribution unit of the total company organization. This plant as

previously mentioned is not in full production and no sales volume was stated.

The average number of employees of this pilot plant is 275. Of this number, 200 are employed in the manufacturing plant, 40 are engaged in clerical and accounting jobs, and the remaining 35 are engaged in administrative phases of the total operations.

The organizational structure places responsibility for the operation of the machine-accounting unit with the plant controller; a chief is in direct charge of the unit. The unit is called the "Data Processing and Business Methods Division." The present unit has been in operation approximately six months. Machines were first installed to fulfill the payroll and labor distribution functions.

Of the 40 employees in clerical and accounting jobs three are employed in the machine-accounting division--the division chief, a machine operator, and a key-punch operator.

Machine-accounting operation.--Because of the relative newness of this unit no specific details have been established or observed that pertain to machine-accounting operations. In the six months the machine-accounting division has been in operation, the number of employees has never exceeded three. In the opinion of the chief, the three persons currently employed constitute an adequate staff for present operations.

Specific accounting functions.--The functions of this machine-accounting division at the time of installation were that of preparation of the payroll and labor distribution. The functions have been expanded to include the preparation of shop clerical records of shipments and accounting for accounts payable. Because of the newness of the plant operation, the added functions had not been started manually to any extent; therefore, at the time the machine-accounting division took over these functions, it was possible to absorb the clerks into other departments.

At the present time there are no anticipated changes in the present Data Processing and Business Methods Division that would concern the machine-accounting unit.

Machine-accounting personnel.--The three employees that constitute the personnel of this division have specific job titles although no attempt has been made to formalize job descriptions.

The Division Chief is a high-school graduate and has some college work. He received his initial training in punched-card equipment on the job with this company. He has been employed for 14 years being promoted from a shop worker to his present position.

The Machine Operator is a high-school graduate and has some college credits. He received his initial training on punched-card equipment on the job. He has been in the

employ of this company for two years being promoted from the shops to his present position.

The Key-Punch Operator is a high-school graduate and received her initial key-punch training from the local IBM key-punch operators school. She has been employed for four months in her present position.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need. The sources of personnel for this division are the local IBM office and through internal promotion or transfers.

Selection devices: All persons who seek employment are required to fill out an application blank containing general information. A screening interview then is conducted by an individual in the personnel department. The final selection of an individual for this unit is contingent upon the approval of the division chief. The IBM aptitude tests are used along with a general intelligence test, a general aptitude test, and a test of dexterity. The applicants are tested by the personnel department. References from previous employment and of character are used in the selection procedure for each person seeking employment. An extensive physical examination is given. General good health is the degree of physical fitness for employment.

Promotion and salaries: Because of the size of this unit and the nature of the positions promotion is not applicable. Information concerning the salaries for the three jobs in the machine-accounting division was not reported.

Qualifications of employees.--Personal traits: The personal traits emphasized for personnel of this division are mechanical aptitude, finger dexterity, initiative, and the desire to change.

Education: A high-school education is required for employment. It was recommended that the supervisor of a machine-accounting unit be a college graduate with specialization in accounting. Typewriting ability is a necessity for the key-punch operators with training in accounting recommended for machine operators. Special machine preparation is required for machine operators and key-punch operators. The machine operators are sent to all courses applicable to the machines of the installation, the key-punch operators to the key-punch course.

Experience: Experience on equipment is not required for employment.

In-service education: This company has no planned in-service education program. Individuals, however, progress through the machines in use until operation of each machine is mastered.

Machine utilization.--Production: The machines in use are one hand punch, two card punches, one sorter, one collator, one accounting, one reproducer, one interpreter, and one calculator. This unit maintains approximately 90 per cent operational efficiency. This high percentage of operational time is anti-typical. The reason for this comparatively high operational time was attributed to the developmental stage of operation. These IBM machines are rented for a monthly fee of approximately \$2,000.

Time and cost savings: Because of the relatively short time this unit has been in operation no effect on time and cost savings has been noted.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. The relatively short period in operation has not indicated any effect on the accuracy factor.

Unique problems.--From the standpoint of management, there are no problems involving personnel that might be directly chargeable to machine processes.

Insurance

This case involves the machine-accounting unit of a division office of an insurance company writing accident and health, hospitalization, surgery, and all forms of life

insurance. This division office services an eight-state area: Oklahoma, Texas, Louisiana, Mississippi, Arkansas, Missouri, Nebraska, and Kansas. It was established in 1935 to service the state of Oklahoma and has gradually expanded into the other states serviced at the time this case was written. The home office is located in Chicago, Illinois. At the time this case study was made, the division office controlled approximately 55,000 participating policies with the volume steadily increasing. There are 100 persons employed by this division office, divided equally between sales force and office personnel. The machine-accounting unit is identified as a department and the department head is on the staff level in a line and staff organizational structure.

The machine-accounting department has been in operation for 11 years. Prior to the installation of punched-card machines, addressing equipment was used in the billing operation. The use of the punched-card system has resulted in no apparent change in number of employees. The employees involved with the new system were sent to the local IBM office to gain familiarity with the machines. Five of the 50 persons employed in office work in this company are in the machine-accounting department--the head of the department, two punched-card machine operators, and two key-punch operators. This is considered by the department head to be an adequate staff for the current operations of this department.

Machine-accounting operation.--The number of employees in this department has varied from four to six over the past five years according to availability of operators, company needs due to increased volume, and equipment changes. During the summer of 1957 the department made an equipment change from a manual card-punching operation to a tape-to-card operation. This eliminated three pieces of equipment--two card punches and a verifier--and two key-punch operators. Two typewriter-to-tape machines and one tape-to-card converter were installed in place of the equipment eliminated. The two individuals who were not needed after reorganization, could have been absorbed into other departments. However, one woman decided to cease working because of her health. The second individual sought employment elsewhere. Shortly after this equipment change, a substantial increase in the number of policyholders required the addition of another employee and a key-punch operator trainee was hired. It was estimated by the head of this machine-accounting department that at least 50 persons would be required to do manually what is now being done by five people with the punched-card system.

Specific accounting functions.--When the punched-card system was first installed, the functions of this department involved only billing and premium accounting. The billing operation now involves monthly, semi-annual, and

annual notices of premium payments of policyholders. Premium accounting includes recording collections, reporting premium transactions to the home office, and calculation of salesmen's commissions.

For the past several years, in addition to the two original functions, this department has been responsible for the preparation of promotional and statistical reports. The promotional reports are prepared for the sales department to be used for sales and advertising purposes. Involved in the preparation of promotional reports is the analysis of claims, over-due premiums, paid premiums, and sales. The preparation of statistical reports was undertaken to provide a more detailed and more rapid review of the division's operations so that officers in the division office might be aided in making managerial decisions.

This division office is contemplating changing from its present method of general-ledger accounting to the use of punched-cards. This would require the employment of one or more additional personnel in the machine-accounting department. The controlling factor for this change is the volume of work to be performed. At the time this case study was completed, the management of the division office considered the general-ledger volume too small for economical punched-card operation. There is also a possibility of changing the billing function from the present paper-premium

notice to the use of a punched card as the premium notice. This would be merely a change in the procedure of an existing function and would required no personnel change.

At the present time the general-ledger, payroll, and other accounting functions are carried on in the accounting department through the use of "pen-and-ink" methods. In recent years, the over-all accounting functions have been extended and the accounting volume has increased as the operations of this division office have been expanded.

Machine-accounting personnel.--Of the five positions in this unit, four are filled by women; the department head is the only man. In his opinion it is preferable to have men operating certain of the punched-card machines because men are more adept in volume work. For the present organization of the machine-accounting department, the following job descriptions were established:

Punched-Card Equipment Operator A: Operates such accounting-statistical machines as tabulators and collators to automatically analyze, calculate and translate information represented by perforations punched in tabulating cards and to tabulate or list desired data on forms or other records; may also operate such related equipment as summary punches, sorters, reproducers, multipliers, and interpreters. This job requires specialized training in and an understanding of the various functions for which the equipment may be used in order to do the necessary wiring of simple program-board arrangements to meet special or unusual situations and do complex program-board arrangements from pre-determined wiring diagrams.

Punched-Card Equipment Operator B: Attends one or more types of accounting-statistical machines (tabulators, summary punches, sorter, reproducers, multipliers, interpreters, collators, etc.) to perform such functions as:

1. Setting appropriate controls and operating machines as specifically directed.
2. Placing pre-wired plug boards in machine and wiring plug boards under specific direction for simple set-ups.
3. Observing machine operation and printed results for any obvious irregularities.
4. Checking tabulated totals against pre-determined control totals.
5. Spot checking of card sorts.

Operations usually are of a re-occurring nature and work is performed under rather close direction.

Key-Punch Operator A: This operator must have considerable experience in operating numeric or alphabetic key-punch machines. The operator is required to record a variety of data by means of perforations on tabulating cards, where the variety of source material, card forms, complex set-up and special instructions require constant and very close attention to the selection of information; to the sequence of recording; and to the use of proper columns. The operator generally examines and verifies, by machine or sight, the punched cards for accuracy and completeness; may examine and verify the work of other key-punch operators.

Key-Punch Operator B--Trainee: This job is the operation of numeric or alphabetic key-punch machines to record precoded or identifiable data by means of perforations on tabulating cards. This work requires care and accuracy to punch data in proper columns, but work generally involves straight, non-interpretative transcription on a limited variety of card forms. The operator may examine and verify by means of machine or sight, the punched cards for accuracy and completeness; may examine and verify the work of other key-punch operators.

These job descriptions depict essentially the same general duties as the descriptions developed by the National Office Management Association.

A summary of the qualifications and experience of the employees in this unit is depicted in the following brief descriptions.

The Department Head has been an employee in the machine-accounting department for eight years, seven in his present position. He was initially employed as a punched-card equipment operator. He is a high-school graduate with one year of college training. His initial training on punched-card equipment was gained in a service school, while in the United States Navy. As a college student, he completed one course in machine accounting. His actual work experience includes one year as a machine operator in the service, one year as a Punched-Card Equipment Operator A with this company, and the seven years in his present position.

The Punched-Card Equipment Operator A is a high-school graduate and received her initial training on punched-card equipment at the local IBM office while employed by another business firm. Her total experience includes six months as a punched-card equipment operator with another firm, one year as a key-punch operator with this company, and four years in the position she now holds.

The Punched-Card Equipment Operator B is a high-school graduate and received her initial training as a key-punch operator through the Oklahoma City Air Material Area

at Tinker Air Force Base. Her training on the punched-card machines, other than key-punch, was through the local IBM office, while in the employment of this business concern. Her total experience with punched-card equipment includes three years as a key-punch operator at Tinker Air Force Base, three and one-half years as a key-punch operator with this concern, and one year in the position she now holds.

The Key-Punch Operator A is a high-school graduate. She received her initial training as a key-punch operator through the installation at Tinker Air Force Base. Her experience includes one year as a key-punch operator at Tinker and four years in her present job classification.

The Key-Punch Operator B is a high-school graduate. She is now engaged in training on the equipment. This person has been employed in general-clerical positions with other businesses. Her experience with punched-card machines involves five months as a trainee with this concern.

Current employment practices.--Sources of personnel: Whenever possible, new employees are hired at the lowest job level and a policy of promotion from within prevails. An exception to this policy involves the hiring of experienced personnel for heads of specialized departments who are then educated concerning the company's procedures and policies. To this date, personnel for this department have been employed largely upon the recommendation of the local IBM

office, which maintains a list of employable people but is not in an actual placement business.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. Upon completion of the application blank, personal interviews are conducted by the personnel manager and the department head. The decision to hire is based on the conclusions reached by both individuals. The key-punch aptitude test for IBM equipment operators is used. This is the only test in the testing program and is administered to those persons making application for the position of Key-Punch Operator B. References are seldom used in the selection procedure; however, if used, references from previous employment are requested. It is interesting to note that, because space is limited, it is deemed necessary for all employees to be small in stature.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded whenever possible as vacancies occur. Information concerning the specific salaries for the four operators was not available. The head of the department did indicate the range of salaries in two positions:

Punched-Card Equipment Operator . . .	\$245 to \$330
Key-Punch Operator.	185 to 260

The head of the department is paid a per cent of profit bonus in addition to a regular monthly salary. The basic salary of

the department head was not stated. The range in salaries reported for this machine-accounting unit indicates that the salaries for key-punch operators are, in general, in line with the NOMA salary survey. The range for punched-card equipment operators is slightly above average.

Qualifications of employees.--Personal traits: The personal traits emphasized include ability to analyze, mechanical aptitude, physical stamina, initiative, and desire to learn new things.

Education: There is no minimum school requirement, although in each position a high-school education is desirable and college training is advantageous for the supervisory personnel. There are no specific course requirements for any of the jobs. It is necessary for the key-punch operators to be proficient typists (50 words per minute is the desired level of proficiency).

Experience: Experience is not required for the basic key-punch operator. However, to gain experience, individuals are sent to the local IBM office for a minimum instruction on key-punch machines. The Punched-Card Equipment Operator B should have at least one year of experience on punched-card machines. It is the opinion of the head of the machine-accounting department that a new person employed in his position, or as a Punched-Card Equipment Operator A, should be brought in from outside the company, rather than to be

promoted from another department and trained on punched-card machines. He believes it is easier to learn company procedures than it is to learn the over-all operation of a machine-accounting installation.

In-service education: This company does not have a specific in-service education program conducted by the supervisory personnel, other than through instruction in specific jobs as problems arise. Employees are occasionally sent to the local IBM office as the need for special instruction arises. The head of the department has on two occasions attended special IBM schools in Oklahoma City. Personnel from other departments are being familiarized with the function of this department in relation to their jobs. This is being accomplished by means of company meetings, meetings of department heads, and through news stories published in a monthly newsletter to all employees.

Machine utilization.---Production: It is usually considered that 60 per cent of capacity in the use of punched-card equipment is an over-load operation. Based on the annual production schedule, the machines in the accounting department of this business during the year 1957 were utilized as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Tape-to-Card Converter:	
Tape-to-card punching	10
Manual key-punching	60
Interpreter	25
Collator.	55
Sorter.	45
Electronic Statistical	
Sorter.	40
Reproducer.	40
Accounting.	75

Other business machines used in the department are a typewriter, and two ten-key, adding-listing machines. One typewriter-to-tape machine is located in the Underwriting Department and another is used in the Claims Department. The two machines are so located because these departments are the points of origination of source documents for information to be punched into the cards. By having the machines in these departments, personnel prepare punched tape for further processing as a by-product of the original preparation of the documents of each department. With the exception of the typewriter and adding-listing machines, the equipment used is rented for \$1,338 per month.

Time and cost savings: There was no significant saving of time in the change-over from addressing equipment to the IBM punched-card equipment. Also, because of functions that were not fulfilled, nor considered practical when prepared manually, no comparison can be made in savings of time. Cost savings cannot be readily attributed to machine

operation because of the additional functions currently involved. Since the added functions were not performed under the old methods, there is nothing to compare by means of cost analysis. There was no specific information to substantiate claims of reduction in time-lag in the preparation of reports for management. It was indicated, however, that many of the statistical reports that are currently prepared were not made available until the IBM equipment was installed. This is true because of the expense and time involved in manual preparation of reports as compared with the ease of assembling data and printing of reports by machine.

Accuracy factor: There are no records kept to indicate whether there were actually any significant improvements in the accuracy factor. Nor were there any records to indicate money or time savings as a result of improvement in accuracy. There are no new errors in the machine method that would tend to off-set the accuracy factor, since checks are set into the process to eliminate the possibility of machine errors.

Insurance

This case involves the machine-accounting unit in the home office of a state farm insurance organization servicing insurance needs of farmers in Oklahoma. The

operations of this organization started in Oklahoma in 1942. Insurance service for farmers includes coverage in the areas of automobiles, fire and casualty, crop hail, farm liability, and farm equipment. At the time this case study was made, the premium volume of all classes of insurance in effect was \$5,000,000 per year.

The organizational structure places responsibility for the operation of the machine-accounting unit with the comptroller; a supervisor is in direct charge of the unit. The unit is called the "IBM Department" and is a part of the Control Group, which consists of the Accounting Department and the Finance Department along with the machine-accounting unit. The present IBM Department has been in operation for eight years. Prior to the installation of punched-card equipment, the functions of this department were performed through the use of key-sort cards.

The total number of employees of this organization is 130. Of this number, 90 are employed in accounting and clerical jobs; 20 are field representatives, adjusters, or underwriters; and 20 are in administrative, supervisory, or staff positions. Of the 90 employees in clerical and accounting jobs, nine are employed in the IBM Department--one supervisor, two machine operators, two key-punch operators, one verifier operator, one part-time machine operator, and two billing clerks.

Machine-accounting operation.--The number of employees engaged in clerical and accounting jobs has increased from 12 to 90 due to increased volume of business. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the eight years the IBM Department has been in operation, the number of employees has doubled. In the opinion of the supervisor, the nine persons currently employed do not constitute an adequate staff; one more key-punch operator is required. At the time of the case interview, a person to fill this position had been hired but had not yet started working.

It was indicated by the supervisor that it would be impossible to estimate accurately the number of persons who would be required to do manually what is currently done by machines. This is true because of the tremendous growth of the operations of both the farm organization and the machine-accounting function within the organization.

Peak load periods occur during December and January and during June and July because of a six-month cycle-billing plan. These two peak periods prevail even though 300 to 1,000 policies are billed per day. It is the consensus of personnel in the IBM Department that this billing process alone would be an impossible task if the accounting machines were not available. Very little overtime is required other

than a varying amount by the supervisor, in preparation of statements, after the first of each month. All the accounting for this organization is done in the home office.

Specific accounting functions.--The functions of this IBM Department at the time of its installation included premium billing and preparation of statistical reports required by law for insurance companies. The functions have been expanded to include preparation of the payroll, calculation of salesmen's commissions, accounting for accounts receivable, accounting for accounts payable, and maintenance of records on company cars. These functions were added as volume increased and it became uneconomical to do the work manually. At the time the machine unit took over these functions, it was not necessary to change any individual from a specific job. In each job converted to machine methods the worker merely assumed new duties. The time savings that resulted were due to the reduced manual effort and clerical detail of the manual operation.

At the present time, this farm insurance organization is preparing for installation of an IBM "305 RAMAC" for work in claims distribution. It is anticipated that eventually all of the functions of this accounting unit will be accomplished with the use of this computer. No reduction in personnel is anticipated due to this change in equipment.

Machine-accounting personnel.--The nine employees who constitute the personnel of this department have specific job titles, but no attempt has been made to formalize job descriptions. It is the policy of this organization to employ men as machine operators and women as billing clerks and key-punch operators.

The IBM Supervisor is a high-school graduate and has attended college for one semester. His initial training on punched-card equipment involved on-the-job training while employed with the Oklahoma City Air Material Area at Tinker Air Force Base. His experience in punched-card operations included a short time at Tinker Field, four years as a machine operator with this organization, and one year in his present position.

In the Machine Operator job classification two men are employed. Both are high-school graduates. These two men were experienced punched-card machine operators at the time of their employment. One of the two has been employed for six years, the other for three years.

The part-time Machine Operator is a high-school graduate and prior to entry into the service had experience on punched-card equipment in the employ of the City of Tulsa, Oklahoma. This individual has been employed for six months as a part-time machine operator. He is a member of the Air Force at Tinker Air Force Base working as a programmer in the Electronic Data Processing Unit.

In the Key-Punch Operator job classification three women are employed. All of these persons are high-school graduates and one completed college. These three women received their initial key-punch instruction as on-the-job training, two with this organization. Two of the three were promoted from clerical positions, the other was hired as an experienced key-punch operator. The latter individual's specific duties involve the verifying function of this unit. One of the three has been employed for four and one-half years in her present position; one has been employed for three and one-half years, two and one-half years in her present position; and the other for two years, five months in her present position.

In the Billing Clerk job classification two women are employed. Both are high-school graduates. Neither is required to operate any of the punched-card equipment. One of the two has been employed for three years, the other for one and one-half years.

Current employment practices.--Sources of personnel: Whenever possible, new employees are hired at the lowest job level and a policy of promotion from within prevails.. Personnel have been employed from the following sources: the local IBM office, commercial employment agencies, and advertising. It was indicated that if necessary any source available would be used.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. Upon completion of the application blank, personal interviews are conducted by the personnel manager and the department supervisor. The decision to hire is based on the conclusions reached by both individuals. As a general rule, tests are not used in the selection process. However, if a situation should present itself in which testing of new employees would be required, such employees would be sent to the local IBM office for testing. Previous employment and character references are considered for each individual seeking employment.

Promotion and salaries: Promotions are based on a merit system. It is the practice of this department to promote individuals from billing clerk to key-punch operator. However, since men are used exclusively as machine operators, the job-promotional sequence stops with the key-punch operator--verifier position. Information concerning the specific salaries for the nine jobs in the IBM Department was not available. The supervisor did indicate the range of salaries, on a weekly basis, in the various positions:

Supervisor	\$98.57 to \$138.65
Machine Operator	70.85 to 92.11
Key-Punch Operator	58.56 to 76.13
Key-Punch Operator--Verifier	64.41 to 83.74
Billing Clerk	48.40 to 69.21

The part-time machine operator is paid on a straight hourly-wage basis at the rate of \$2 per hour. The range in salaries reported indicates that probably the actual salaries paid key-punch operators and machine operators are above average as compared with the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal trait emphasized for all personnel is power to concentrate in the face of the noise produced by the machine operation. It was the opinion of the person interviewed that the supervisor of a machine installation should be mechanically inclined.

Education: No specific level of formal education is required for employment for any of the positions; however, a high-school education is recommended. No specific courses were considered as very essential but ability to typewrite accurately is desired, with a speed requirement of at least 50 words a minute. It was indicated that bookkeeping or accounting would help the machine operator and supervisor understand better what was being accomplished through their jobs.

The recommendation for special machine training included Key-Punch Operators' School for the key-punch operators and the Basic Machine Operators' Course and the Functional Wiring Course for machine operators. These courses are available through the local IBM office.

Experience: Experience on punched-card equipment is not required for employment. When possible, a machine operator is required to have at least one year of experience along with the two basic IBM courses mentioned under the heading of Education.

In-service education: This company does not have an in-service education program of any type.

Machine-utilization.--**Production:** The machines in use in this installation are as follows: three card punches, one verifier, two sorters, three collators, two accounting, one interpreter, one reproducer, and one summary punch. No records are kept to indicate operational time for any of the equipment. This department also has four 10-key adding-listing machines and one electric typewriter. The IBM machines are rented at a monthly rate of \$2,400. Because of the nature of the operation of this organization the cost of equipment is charged against an equipment account.

Time and cost savings: A significant saving of time was indicated but there has been no study to establish any definite dollar amounts or percentage figures on the savings. The savings in time are realized through increased volume without increase in time required to process the data. It was the opinion of the supervisor that, compared with the manual operation, the machine procedures take about the same time span to process a much larger volume.

Case No. 23

Accuracy factor: There were no records to indicate whether there was any significant improvement in accuracy. The person interviewed indicated that accuracy was a negligible item because of the high degree of accuracy required regardless of the method of processing accounting information.

Unique problems.--In the opinion of the supervisor interviewed, there were no apparent problems that could be attributed to the utilization of punched-card accounting equipment. He did indicate that to most of the personnel the installation of machines offered relief in that the machines took over the voluminous detailed work required.

Case No. 24

Insurance

This case pertains to the operations of the home office of an insurance company writing accident, hospitalization, and all forms of life insurance. The company was organized in 1948 with its home office located in Oklahoma City. This company has 25 branch offices located throughout 14 states of the central and southwest parts of the United States. From its beginning this company has steadily grown. It was related that in the past four years, for example, policy volume has increased four times. At the time this case study was made this insurance company controlled approximately 100,000 participating policies.

The average number of employees is 300. Of this number, 25 are employed as secretaries in the branch offices, 65 are engaged in clerical and accounting jobs, and the remaining 210 employees are engaged in sales and administrative phases of the total operation.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Administrative Vice-President; a manager is in direct charge of the unit. The unit is called the "Machine-Records Department." The present Machine-Records Department has been in operation approximately four years. Machines were first installed to fulfill the billing function. Of the 25 employees in clerical and accounting jobs within the home office, eight are employed in the machine-records department--one manager, three machine operators, three key-punch operators, and one control clerk.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the four years the machine-records department has been in operation, the number of employees has been reduced from nine to the eight presently employed. One person left the employment of this company and was not replaced.

In the opinion of the supervisor, the eight persons currently employed constitute an adequate staff for present operations. In the operation of this department, no overtime is required. During peak periods two shifts are utilized. The shifts are made up by splitting the number of machine personnel into two operational shifts. The manager indicated that he would not even attempt to estimate the number of additional persons who would be required to do manually what is currently done by machines.

In this insurance company, the first ten days of each month is a peak operational period requiring a two-shift operation. During this period, the punched-card equipment is operated from 12 to 16 hours each day. It is the consensus of personnel in the machine-accounting unit that this would be a monumental task if the accounting machines were not available. Through the use of punched-card methods, it is possible to absorb an increase in accounting operations, because of increased volume of insurance written, without additional personnel.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was that of premium billing. The functions have been expanded currently to include accounts receivable accounting, general ledger accounting, check writing, claims statistics and life evaluation. These functions were added when it was determined

that this work could be accomplished more rapidly and with less expense than by other means. When the machine unit took over these functions, no change in personnel requirements were apparent. The use of machine methods now is bringing about a reduction in the total number of individuals employed. It has been found that as clerical employees leave the employment of this company, there is no need to replace them. No information was revealed relative to a point at which time it would be necessary to replace persons who sever employment. At the present time, no changes or additions to the existing functions are anticipated.

Machine-accounting personnel.--The eight employees who constitute the personnel of this department have specific job titles, although no attempts have been made to formalize job descriptions.

The Manager of Machine-Records has been employed for four years and has been the Manager of the Machine-Records Department from its beginning. He is a high-school graduate and has completed two years of college. His knowledge of punched-card equipment was obtained on the job while employed in a state agency. His total experience includes several years as a stenographer and manager of supplies, seven years as punched-card equipment operator with the state, and the four years in his present position.

In the Machine Operator job classification three men are employed. All three are high-school graduates and one has completed one year of college. The three individuals received their initial instruction on punched-card equipment as on-the-job training, one with this company and the other two in state agencies. Of the latter two individuals, one had two years experience on punched-card equipment the other one year. One of the three men has been employed for three years, one for six months, and one for four months.

In the Key-Punch Operator job classification three women are employed. All three are high-school graduates and one has completed three semesters of college. These women all received their initial instruction in key-punch operations through on-the-job training, two with this company, one with another business concern. The latter individual had two years of key-punch experience at the time of her employment. One of the three has been employed for four years, one for two years, and the other for eight months.

The Control Clerk is a high-school graduate and has completed three years of college. She received her initial key-punch instruction as on-the-job training in another business concern. She had five years of key-punch experience prior to her employment. She has been employed for two and one-half years, two years as a key-punch operator and six months in her present position.

Current employment practices.--Sources of personnel:

New employees are hired for office jobs at the job levels in which there is a need. The sources of personnel for this department are the local IBM office, the Oklahoma State Employment Service, and other supervisors of machine units.

Selection devices: All persons who seek employment are required to fill out application blanks for general information. An interview is conducted by the department manager who has the responsibility of selection of competent individuals for his department. The IBM key-punch and machine aptitude tests are used along with a general aptitude test. The tests are administered by the department manager. References from previous employment are used in the selection procedure. Very little use is made of character references. No physical examination is given. It was reported that any crippling handicap would eliminate an individual from employment.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when a vacancy occurs. Information concerning the specific salaries for the eight jobs in the machine-accounting unit was not made available. The supervisor did indicate the starting salaries in two positions to be \$300 for Machine Operators, and \$200 for Key-Punch Operators. No information relative to the manager's salary was stated. The beginning salaries reported indicate

that probably the amounts paid are average or above as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized by the supervisor in this unit were mechanical inclination on the part of machine operators and manual dexterity in the case of key-punch operators.

Education: A high-school education is required. Typewriting is considered to be essential for key-punch operators and training in accounting is recommended for machine operators. Fifty to 70 words per minute is the desired typewriting proficiency. No special machine preparation other than experience on punched-card equipment is required. It was indicated that experience prior to special machine instruction makes the machine course more meaningful. It was stated that in the selection of supervisors experience on punched-card equipment is more essential than knowledge of the specific business concern involved.

Experience: Experience on punched-card equipment is not a specific requirement for employment. In this company, the normal procedure is to hire young people and then train them in all jobs. However, it is the opinion of the manager that it is desirable for machine operators to have had at least two years of experience prior to employment in the unit. In the case of key-punch operators, six months of experience is desirable.

In-service education: This company has no planned in-service education program. If time permits, machine operators are sent to the local IBM customer training school for specific machine instruction.

Machine utilization.--Production: The machines in use are: one Card Punch, one Verifier, two Sorters, three Collators, two Accounting Machines, two Reproducers, one Interpreter, four Typewriter-To-Card Machines, and one Adding-Listing Machine. This company does not have records to indicate actual machine operational time. However, it was related by the manager that he strives for at least 75 per cent in over-all machine utilization. The IBM machines are rented for a monthly fee of \$2,600.

Time and cost savings: A significant saving of time was indicated by the manager of the unit. However, there are no studies to establish definite dollar amounts or percentage figures.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy as a result of machine utilization. However, based on the statement, "for every job that was taken on, one of the basic reasons was improvement in accuracy," it is assumed that increased accuracy has resulted in time and money savings.

Case No. 24

Unique Problems.--The Manager indicated that, at the time the change from manual methods to machine methods was made, a personnel problem existed that could be attributed to resistance to change. Soon after the change-over was completed, an improvement in systems was apparent. Because of this, the machine method was accepted at all levels of employment within a relatively short time.

Case No. 25

Insurance

This case pertains to the operations of the home office of an insurance company. The company was organized in 1929 and currently is licensed to do business in 37 states and the District of Columbia. The company writes a complete insurance service including life insurance, accident, and health insurance, credit insurance, and special policies. The types of life insurance include estate planning, retirement income, savings, endowment, education trust fund, limited-pay life, ordinary life, term, and group life. The accident and health coverage includes medical, hospitalization, loss of time, doctors' calls, group accident and health, and student accident. Credit insurance covers all types of loans against death or loss of time. The special policies cover cancer and 12 other dread diseases.

There are 12 regional offices located in major cities in Oklahoma, Missouri, Arkansas, Tennessee, and Mississippi.

There are also three state agencies located in Portland, Oregon; Chicago, Illinois; and Detroit, Michigan. As of July 1, 1958 this company had \$188,599,608 of insurance in force.

The average number of employees in the home office of this company is 110. Of this number, 12 are employed in the accounting department and the remaining 98 employees are engaged in other phases of the total home office operation. This company also has 1,980 active agents ranging from only one in some states up to 670 in Oklahoma.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Director of Accounting, who is an assistant Vice President. A machine supervisor is in direct charge of the unit. The unit is called the "Tabulating Department of the Accounting Department." The present machine-accounting department has been in operation approximately one and one-half years. Machines were first installed to fulfill the accounting for and billing of premiums. During the last three months of 1956, the only function performed was punching cards for premium billing. In January, 1957, the actual installation of Remington-Rand equipment was accomplished, which included the addition of tabulating and accounting machines to bring the number of machines in this department to ten.

Of the 12 employees in accounting jobs, eight are employed in the machine-accounting department; the director of accounting, one supervisor of machine operators, four machine operators, and two clerks. The machine operators in this unit perform key-punching and control clerk functions.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the one and one-half years the machine unit has been in operation, the number of employees has never exceeded eight. In the opinion of the Director of Accounting, the eight persons currently employed constitute an adequate staff for present operations. It was estimated that 15 additional persons would be required to do manually what is currently done by machines.

Peak-load periods have been eliminated through a daily billing cycle. Work scheduling and the ability of each machine operator to operate all machines, allows for easy adjustment of both machines and personnel to account for any unforeseen deviation from normal accounting-data processing. No overtime is required of the machine-accounting personnel to complete the operations of this department.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was that of premium accounting. The functions have been expanded to include preparation of agents' financial reports. Premium accounting includes the maintenance of a policyholder's history record, and payment record. Premium billing is also considered as a part of this function. The billing procedure includes the preparation of premium notice cards and if needed, notice of payment past due and reinstatement cards. Agents' financial statements became an added function as a by-product of premium accounting. The utilization of machines has not caused any elimination of employees. In any instance where a specific job has been eliminated normal attrition has allowed for absorbing the individual displaced. At the present time, there is no change in the functions of this machine-accounting unit.

Machine-accounting personnel.--The eight employees who constitute the personnel of this department have specific job titles although no attempt has been made to formalize job descriptions.

The Director of Accounting is a college graduate with a degree in accounting. He received his initial training on punched-card equipment through on-the-job training with this company. His total experience includes two years in the accounting department and three years in his present position.

The Supervisor of Machine Operators is a high-school graduate and received her initial training on punched-card equipment through on-the-job training with this company. Her total experience includes nine years as an employee of this company, clerical and supervisory positions in other department and three years in her present position.

In the Machine Operator job classification four women are employed. All four of these individuals received their initial punched-card machine instruction as on-the-job training with this company. The four women were all employed as clerical workers and promoted to their present positions. One of the four has been an employee for two years, one for one and one-half years, and the other two for one year.

In the Clerk job classification two women are employed and both are high-school graduates. Both of these two individuals have been employed for approximately one year. Neither of the two had previous work experience.

Current employment practice.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need. The sources of personnel are the Oklahoma State Employment Service and other departments within the company.

Selection devices: All persons who seek employment are required to fill out an application blank for general

information. An interview is conducted by the Personnel Manager. The final selection of an individual for this unit is contingent upon the approval of the Director of Accounting. The B-3 Test of General Intelligence is administered to all applicants through services of the Oklahoma State Employment Service. A score of 110 or over is considered to be suitable for any type of job. Previous employment and character references are used in the selection procedure for each individual seeking employment.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when vacancies occur. Information concerning the specific salaries for the eight jobs in the machine-accounting unit was not available. It was indicated that the range of salaries in three of the positions was from a starting salary of \$175 to a top salary of \$285 a month. No information relative to the Director of Accounting's salary was stated because of company policy. The range in salaries reported for this unit indicates that probably the actual salaries paid are average as compared with the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized are an even temperament, an analytical mind, and physical activeness. It is also required that employees have average or above average intelligence.

Education: A high-school education is required for employment. Bookkeeping and mathematics were recommended as courses all machine personnel should have in their formal education. A college degree in accounting would be of value for supervisors but not a necessity. No special machine preparation is required. All persons are trained on the job.

Experience: Experience on punched-card equipment is not required for employment, in fact, inexperienced persons are preferred.

In-service education: This company has no planned in-service education program.

Machine utilization.--The machines in use and the percentages of time in operation are:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (2)	60
Sorter.	60
Reproducing-Collator (3). .	60
Accounting.	60
Interpreter (2)	60

These Remington-Rand machines are rented for a monthly fee of \$1,100.

Time and cost savings: A significant saving of time was indicated in a statement from the Director of Accounting. There has been no study to establish definite dollar amounts or percentage figures. It was estimated that the same volume processed under manual methods would take approximately twice the amount of time required for machine processing.

Case No. 25

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy.

Unique problems.--The Director of Accounting indicated that the main problem encountered in changing from "pen-and-ink" methods to machine methods was the fear of loss of jobs by accounting and clerical personnel through ignorance of the benefits of machine utilization. This was overcome by announcements to the employees of information in relation to the change-over well in advance of the actual change. This procedure aided in making the change a natural transition.

Case No. 26

Insurance

This case pertains to the operation of the home office of an insurance company organized in 1929. In 1949, through mergers with smaller companies, the organization as it is known today came into existence. The company writes all forms of life, accident, health and hospitalization, and polio insurance. The present sales coverage is limited to 27 states in the south and mid-west areas of the United States. Plans are being formulated to expand to a nationwide operation in the near future. This company has a premium income of between \$15,000,000 and \$16,000,000 per year.

The average number of employees is approximately 5,100. Of this number, 100 are engaged in clerical and

accounting jobs, and the remaining 5,000 employees are engaged in sales phases of the total operation.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Head of Premium Accounting who is directly responsible to the President; a Supervisor is in direct charge of the unit. The unit is called the "Machine-Accounting Department," referred to informally as the "IBM Department." The present machine unit has been in operation approximately six years. Machines were first installed to fulfill the premium accounting function.

Of the 100 employees in clerical and accounting jobs, ten are employed in the IBM Department--one supervisor, three machine operators, and six key-punch operators.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs throughout this company due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the six years the machine unit has been in operation, the number of employees has increased from two to ten. In the opinion of the supervisor, the ten persons currently employed constitute an adequate staff for present operations, except for several hours of overtime required of machine operators in the preparation of

monthly reports, semi-annual reports, and annual reports.

It was estimated that 100 additional persons would be required to do manually what is currently done by machines.

In this insurance company, all issuance of policies and billing of premiums are accomplished in the home office. It is the consensus of personnel in the IBM Department that this would be a monumental task if the accounting machines were not available. Through the use of punched-card methods management now receives reports of value that were not even envisioned when manual methods prevailed.

Specific accounting functions.--The function at the time of installation was largely that of premium accounting. The functions have been expanded to currently include accounting for legal reserves on policies in force, check writing for accounts payable, and preparation of claims reports for management. These functions were added when it was determined that this work could be accomplished more rapidly and with less expense than by other means. When the machine-accounting department took over check writing for accounts payable, it was possible to eliminate one clerk because of the reduced manual effort required. It is anticipated that the IBM "305 RAMAC" will be installed within the next year to process the accounting information for this company. It is thought that three to four jobs will be eliminated. However, because of this equipment change, new

jobs will be created that will absorb any individual whose job will be taken over by the new machine.

Machine-accounting personnel.--The ten employees who constitute the personnel of this department have specific job titles although no attempt has been made to formalize job descriptions.

The Supervisor is a college graduate and received his initial instruction on punched-card equipment through one of the courses in his college preparation. His total experience includes six years in the employ of this company. One of the six years was in general accounting, the other five were in the IBM Department. He has been in his present position for two years.

In the Machine Operator job classification there are three men employed. All three of these men are high-school graduates and one has completed one year of college. Two of the three received their initial instruction on punched-card equipment as on-the-job training with this company, the other one through machine operator classes at the local IBM office. One of the three has been employed for one and one-half years, one for eight months, and the other for three months.

In the Key-Punch Operator job classification six women are employed. All of these persons are high-school graduates and received their initial key-punch instruction through the local IBM office. These six women were all hired

as Key-Punch Operators. One of the six has been employed for six years, one for three years, two for one year, and the other two have been employed less than one year.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need. The sources of personnel for this department are public employment agencies.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. An interview is then conducted by the Head of the Premium Accounting Department who is responsible for employing competent individuals for the machine unit. References from previous employment, character references, and a retail credit check are used in the selection procedure for each individual seeking employment.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when vacancies occur. Information concerning the specific salaries for the 10 jobs in the machine-accounting unit was not available. The supervisor did indicate his salary and the average salaries in the two other positions to be: Supervisor \$365, Machine Operators, \$225, and Key-Punch Operators \$200. These average salaries are somewhat below average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized are the ability to concentrate and mechanical aptitude.

Education: A high-school education is required for employment and a college degree is recommended for the supervisor. Typewriting ability is a necessity for the key-punch operators with instruction in accounting recommended for machine operators. Instruction in accounting is required of supervisory personnel, and a mathematics background is recommended as highly desirable. Special machine preparation is not required for machine operators. It was indicated that the supervisor should have attended the IBM courses on machine operation and board wiring. These courses would be helpful for machine operators, after some actual machine experience. Key-punch operators are required to attend the key-punch course if they are not experienced key-punch operators.

Experience: Experience on punched-card equipment is not required for employment; however, when possible experienced operators are employed. It was emphasized that, because of differences in machine-accounting units, an indication of experience in some instances has very little meaning.

In-service education: This company has no planned in-service education program. On-the-job instruction is given on specific procedures when needed.

Machine utilization.--Production: The machines in use and the range in per cent of time in operation are:

<u>Machine</u>	<u>Per Cent of Time In Operation</u>
Card Punch (2)	50 - 75
Verifier (2)	50 - 75
Sorter (2)	50 - 75
Collator (2)	50 - 75
Accounting (2)	50 - 75
Reproducer (2)	50 - 75
Interpreter	50 - 75
Typewriter-to-card.	50 - 75

These IBM machines are rented for a monthly fee of approximately \$3,000.

Time and cost savings: A significant saving of time was indicated in a statement from the supervisor. However, there has been no study to establish definite dollar amounts or percentage figures. Agents' commissions, for example, took two and one-half weeks to prepare by manual methods, whereas, commission checks now are ready for distribution to agents within three to five days.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. However, it was indicated that there was "no comparison" of the accuracy attainable, between manual and machine methods.

Unique problems.--The supervisor indicated that the main problem encountered in changing from manual methods to machine methods was a general lack of understanding, causing

doubt by many individuals of the data processed by machine methods. This is being overcome by explanations of the machine operation to all individuals using machine prepared reports and records. From the standpoint of management, there were no problems involving personnel that might be directly chargeable to machine processes. Normal attrition has made unnecessary any special provision for persons temporarily not needed during the change-over period.

Petroleum Producing and Distributing

This case pertains to the operations of a subsidiary company of a petroleum producing and distributing company. The subsidiary company was organized in 1931 through mergers of several small companies. Its activities are confined to the exploration and production for the parent company. Prior to 1951 this subsidiary operation was controlled through the home office, located in Tulsa, Oklahoma. Since 1951 the operations have been decentralized, forming divisions. The division offices are located in Houston, and Fort Worth, Texas; Oklahoma City, Oklahoma; and Casper, Wyoming. This case reports the operations of the machine-accounting unit in the Oklahoma City division office. The net sales volume of this subsidiary company is approximately \$100,000,000 per year.

The average number of employees of this division office is 575. Of this number, 150 are employed in the production department, 225 are employed in the accounting department, and the remaining 200 employees are engaged in the exploration department.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Division Manager; a Supervisor is in direct charge of the unit. It is called the "Tabulating Section of the Accounting Department." The present Tabulating Section has been in operation approximately seven years. Machines were first installed to fulfill general accounting functions.

Of the 225 employees in the accounting department, 23 are employed in the machine-accounting unit--one tabulating supervisor, two tabulating group heads, one administrative clerk, one senior machine operator, three machine operators, two junior machine operators, two senior key-punch operators, ten key-punch operators, and one file clerk.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the seven years the tabulating department has been in operation, in the Oklahoma City area, the number of

employees has steadily increased from 17 to 23. In the opinion of the supervisor, the 23 persons currently employed constitute an adequate staff for present operations. It was estimated that 40 additional persons would be required to do manually what is currently done by machine. No overtime operation is required to handle the peak operational load which occurs about the first of each month. It is the consensus of personnel in the machine-accounting unit that the growth in data processing required by greatly increased business volume, would be a monumental task if the accounting machines were not available. The supervisor expressed the opinion that governmental reports helped to put the big machine manufacturing companies into business.

Specific accounting functions.--The function of this machine unit at the time of installation was that of general accounting. General accounting includes all phases of the general ledger accounting--recording, classifying, summarizing and analyzing. Information from source documents is punched into cards, which are used to complete the general accounting function and preparation of related statements. The general effect on employees has been an up-grading of accounting and clerical workers. The use of machine methods in accounting has allowed the company to grow, providing more jobs and better jobs for long-service employees.

It is anticipated that the clerical work of the engineering department will be added to the functions of the Tabulating Section of the Accounting Department. This will relieve the engineering department of a great deal of clerical burden. No re-location of personnel is anticipated.

Machine-accounting personnel.--The 23 employees who constitute the personnel of this department have specific job titles and complete job descriptions. Because of the nature of the binding of these job descriptions they are considered classified material and not available to this researcher.

The Tabulating Supervisor has been employed by this company for 14 years and has been the supervisor of the machine-accounting department for seven years. This person was initially employed as a mailing clerk and was promoted through the machine-accounting department to his present position. He is a college graduate with a major in accounting. His knowledge of punched-card equipment was obtained on the job with this company.

The two Tabulating Group Heads are both college graduates with degrees in accounting. Both of these men received their initial instruction on punched-card equipment as on-the-job training with this company. Both were originally employed in the accounting department and have been

with the company for 16 years. One of the two has been in his present position for five years, the other for two years.

The Administrative Clerk is a college graduate with a degree in mathematics. His total experience includes two years as a trainee with this company and one year in his present position.

The Senior Machine Operator is a college graduate with a degree in accounting. His initial instruction on punched-card equipment was on-the-job training while employed at Tinker Air Force Base. His total experience includes one year as a machine operator at Tinker, four years as a machine operator with this company and two years in his present position.

In the Machine Operator job classification three men are employed. All are college graduates with degrees in accounting. Their initial training on punched-card equipment was on-the-job training with this company. These three men have all been employed approximately four years, two as junior machine operators and two in their present positions.

Two Junior Machine Operators are employed. Both of these men are college graduates with degrees in accounting. Their initial instruction on punched-card equipment was on-the-job training with this company. These two men have been employed for one and one-half years as Junior Machine Operators.

In the Senior Key-Punch Operator job classification two women are employed. These two women received their initial key-punch training on the job in other business concerns. These individuals have had previous key-punch experience and have been employed with this company for approximately six years--two years as key-punch operators and four years in their present positions.

In the Key-Punch Operator job classification ten women are employed. These ten individuals are all high-school graduates and they all received their initial instruction in key-punching through on-the-job training with this company. Their average length of employment is five years.

The File Clerk is a high-school graduate. He was employed as a "Hall-boy," which is a messenger job. His total experience includes one year as a messenger and one year in his present position.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need. Any source is used for locating key-punch and clerical personnel for this department. Accounting-machine operators are selected from direct contacts with colleges and universities.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. A screening interview is conducted by an

interviewer in the Industrial Relations Department. The final selection of an individual is contingent upon the approval of the Tabulating Supervisor. A general aptitude test is administered to all potential employees in the Industrial Relations Department. References from previous employment along with character references are used in the selection procedure for each individual seeking employment, a regular procedure of the Industrial Relations Department. An extensive physical examination is given. A grade of A on the physical examination means perfect health; a grade of B indicates a repairable defect. Any person given one of these two grades is considered employable.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when vacancies occur. Information concerning the specific salaries for the 23 jobs in the machine-accounting unit was not reported. The supervisor did indicate that the salaries paid in all positions were well above the average as compared to other salaries in the Oklahoma City area and the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized for accounting-machine personnel were aptitude for technical work and analytical mind. Key-punch personnel should have a high degree of finger dexterity. The supervisor indicated that in many cases a divorcee makes

the best key-punch operator. Because of their family responsibilities they are usually more stable employees.

Education: A college degree with a major in accounting is required for all punched-card accounting-machine operators. A high-school education is required for key-punch and clerical personnel; if possible, individuals with some college training are preferred in these job classifications. No special machine preparation is required. The punched-card equipment is considered as a tool for data processing, a basic understanding of the company and a general business knowledge is desired over machine preparation.

Experience: Experience on punched-card equipment is not required for employment. In this machine-accounting unit education and general business background is considered more important than actual work experience on punched-card machines.

In-service education: No planned in-service education program is conducted. Employees are sent to the local IBM schools after some actual job experience with this company. General discussions concerning the utilization of automated equipment are presented in organized company meetings to acquaint personnel with the work the machine unit is accomplishing.

Machine utilization.--**Production:** The machines in use and the per cent of time in operation of the punched-card equipment are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (7).	100
Verifier (3).	100
Sorter.	75
Collator (3).	75
Accounting (5).	75
Reproducer (3).	75
Interpreter	75
Calculator (2).	75
Adding-Listing.	--
Desk Calculator	--
Typewriter.	--

The IBM machines are rented for a monthly fee of \$5,500.

All other office machines in use in this unit have been purchased.

Time and cost savings: A significant saving of time and cost was emphasized by the supervisor in reporting that through machine utilization no overtime is required. There has been no study to establish definite dollar amounts or percentage figures.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. However, it was reported that the machines are highly accurate in processing accounting data.

Unique problems.--The supervisor indicated that there were no problems involving personnel that might be directly chargeable to machine processing of accounting data. Normal operational problems expected in any business operation are in existence, but none are unique to the machine unit.

Petroleum Producing and Distributing

This case pertains to the operations of the home office of a natural gas producing and distributing company that is a subsidiary of a holding company. The subsidiary company was incorporated in 1932 and its activities are confined to production, purchase, transmission and sales of natural gas at wholesale. The parent company dates back to 1904 when several small natural gas companies merged forming the company that is in operation today. The home office represented in this study is the center and focal point for the operations of 50 out-lying stations that perform the field work required to carry out the activities of the company. The distribution of natural gas by this company is on a national basis. The annual sales volume is approximately \$67,500,000.

The average number of employees, excluding the personnel in field stations, is 247. Of this number, 58 are employed in executive positions, 134 are engaged in clerical and accounting jobs, and the remaining 58 are engaged in other capacities in the following departments: Legal, Production, Geological, Land, and Treasury.

The organizational structure places responsibility for the operation of the machine-accounting unit with the head of the Accounting Section, of the Corporate Secretary's Group. A Department Head is in direct charge of the unit.

The unit is called the "IBM Department of the Accounting Section." The present machine-accounting department has been in operation approximately four years. Machines were first installed to fulfill the functions of sales billing and statistics. Of the 134 employees in clerical and accounting jobs, seven are employed in the machine-accounting department--one department head, two machine operators, three key-punch operators, and one facsimile-posting machine operator.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. Employment records show an increase in the number of employees in the total employment of this company. In the four years the machine-accounting unit has been in operation, the number of employees has never exceeded eight. In the opinions of the person interviewed, in addition to the seven persons currently employed, one more machine operator is needed to adequately staff this department for present operations. Overtime required of machine-accounting personnel is the exception rather than the rule. It was estimated that at least twelve additional persons would be required to do manually what is currently done by machines.

Many statistical and other type reports are constantly required for presentation of evidence before the federal regulatory board, when requesting necessary rate changes. It is the consensus of personnel in this department that this would be a monumental task if the accounting machines were not available. In the past manual preparation of case material required two to three months; through utilization of machines this material can be available in 24 hours.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was that of sales billing and statistics. The functions have been expanded to currently include preparation of the payroll, equipment accounting, and preparation of gas measurement reports. Preparation of the payroll was added when it became apparent that the extensive clerical burden in the manual preparation of the payroll could be drastically reduced with the machines available. The assumption of the payroll function resulted in the re-location of payroll clerks within the company. Any decrease in jobs is compensated for by not replacing individuals when someone leaves employment. Completion of gas measurement reports by machine allowed this company to eliminate a sub-office in Wichita, Kansas. All employees of this office were given the opportunity to move into other positions for which they were qualified.

It is anticipated that several engineering department jobs will be added to the functions of the department. One job that will definitely be prepared for processing in the machine-accounting unit, has just been completed using manual methods. Three years were required to complete the job manually. The application consists of 33,000 formula calculations requiring one-half day per calculation manually. The punched-card calculator can complete 50 calculations per minute with verification of results.

Machine-accounting personnel.--The seven employees that constitute the personnel of this department have specific job titles although no attempt has been made to formalize job descriptions.

The Department Head is a college graduate with a degree in accounting. He received his initial training on punched-card equipment on the job with this company. His total experience includes 12 years of employment with this company--eight in the accounting department and four in his present position.

In the Machine Operator job classification two men are employed. These two men are both high-school graduates. One of the two received his initial instruction on punched-card equipment through on-the-job training in another company, the other one through the classes conducted by the local IBM office. Both were experienced operators at the

time of their employment, one for five years the other for one year. One of the two individuals has been employed for four years the other one for one year.

In the Key-Punch Operator job classification there are three persons employed. All three of these women are high-school graduates and received their initial instruction in key-punch operation as on-the-job training. One of the three has been employed for 15 years, one year in her present position. This person was transferred into this department after the job she had held was eliminated because of the machines. Of the other two persons, one has been employed for four years and the other for three years.

The Facsimile-Posting Machine Operator is a high-school graduate and is a long-service employee of this company. She was transferred from the duplicating department and has been in her present position for eight months.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need. The sources of personnel are the local IBM office, private employment agencies, and by word-of-mouth.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. Screening interviews are conducted by the personnel officer and Assistant Treasurer. A final interview

is conducted by the department head, and selection of an individual is contingent upon his approval. In this unit the IBM key-punch and machine aptitude tests are used. The applicants are also given an operational trial on the machines to check their skill as operators of punched-card equipment. Both previous employment and character references are used in the selection procedure of each individual seeking employment. An extensive physical examination is required. Physical defects that would eliminate an individual from employment were impaired sight and hearing, and inability to use one's legs.

Promotion and salaries: Promotion is primarily from within and individuals are up-graded if possible when vacancies occur. The salaries for two of the seven jobs in the machine-accounting unit are: Department Head \$575 and one Machine Operator, considered the chief operator, \$450. It was also indicated that the salary range for the two other Machine Operators was \$300 to \$350, and the average salary for Key-Punch Operators was \$300. No information relative to the Facsimile-Posting Machine Operator's salary was stated. The salaries reported for this machine-accounting unit are above average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized for personnel of this department

are mathematical mindedness for supervisory personnel and machine operators, and dependability and congeniality for key-punch operators. A high aptitude for machine work was also stressed.

Education: A high-school education is required for employment in the machine-accounting unit of this company. Typewriting ability is desirable but not a necessity for key-punch operators. A mathematics background is recommended for machine operators. Special machine preparation includes specialized machine courses and the punched-card management course for supervisors, basic machine operation and functional wiring courses for machine operators, and the key-punch operators course for key-punch operators.

Experience: Experience on equipment is required for employment. In this department attempts are made to insure that both key-punch operators and machine operators have at least one year of punched-card experience prior to employment.

In-service education: This company requires key-punch operators to spend a 90-day in-service instruction period, before actually being placed on productive work. Machine operators are required to go through a 6-month on-the-job training program. An informal educational procedure acquaints the employees in other departments in the aspects of punched-card procedures that affect them.

Machine utilization.--Production: The machines in use and the per cent of time in operation are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (2).	100
Verifier.	100
Sorter (3).	75
Collator.	75
Accounting.	105
Reproducer.	75
Interpreter	25
Computing Punch	75
Calculator.	75
Facsimile Posting	--

The IBM machines are rented for a monthly fee of \$1,700.

Time and cost savings: A significant saving of time was shown in a statement from the person interviewed in relating computation of an engineering formula; 55 man years manually are compared to 11 hours with the machine. A definite dollar savings was reported on a specific job that took two months to process manually by a \$600-a-month employee; the total machine processing cost was \$300, and actual savings of \$900 was realized. Another example of dollar savings was related in the immediate availability of reports and statistics for use in rate cases. Under manual methods two to three months were required to compile the necessary data for these rate cases. The same data can be compiled in 24 hours through machine utilization. It is estimated that \$1,000 per day is saved in interest alone, over the period of time saved.

Case No. 28

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. However, based on the statements made by the person interviewed it is assumed that increased accuracy has resulted in definite savings for this company. It was emphasized that all work is verified by machine whereas accuracy proof was impractical manually.

Unique problems.--It was indicated that the main problem encountered in changing from manual methods to machine methods was the fear of loss of jobs by accounting and clerical personnel. This was overcome by announcements to the employees of information in relation to the change-over well in advance of the actual change. This procedure aided in making the change a natural transition.

Case No. 29

Petroleum Producing and Distribution

This case pertains to the operations of the headquarters office of an oil production company that is a subsidiary of a holding company. The subsidiary company was organized in 1911 when the parent divided into 34 separate and independent companies. The home office of the parent company is located in Cleveland, Ohio. This company is the production unit of the parent company, supplying crude oil and gas to the distributing companies. The operation of this company includes both foreign and domestic programs.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Assistant Comptroller; a manager is in direct charge of the unit. The unit is called the "Tabulating and Production Control Unit." The present machine-accounting unit has been in operation approximately 11 years. Machines were first installed to fulfill the function of writing accounts payable checks. Of 115 individuals employed in the headquarters office, 18 are employed in the machine-accounting unit: one manager, one second man, one group supervisor, one control clerk, five machine operators, seven key-punch operators, and two clerks. The control clerk is also the key-punch supervisor.

Machine-accounting operation.--There has been a decrease in the number of employees throughout this office, however, this decrease is because of economic conditions and cannot be attributed to the use of machines. Machines have made it possible to maintain proper accounting records without adding accounting employees, during a period of continuous growth. In the 11 years the Tabulating and Production Control Unit has been in operation, the number of employees has never exceeded 18. In the opinion of the manager, the 18 persons currently employed constitute an adequate staff for present operations. It was emphasized by the manager that it would be impossible to estimate the number of

additional persons that would be required to do manually what is currently done by machines. Many reports and statements would be impossible to prepare under manual methods.

In this company, the first ten days of each month constitute the peak period of operation. No overtime is required, however, to accomplish the processing of accounting data during this period or at any other time. The elimination of overtime was attributed to improved procedures made possible through the use of punched-card machines.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was that of accounts payable check writing. The functions have been expanded to include complete mechanization of accounting procedures, from the original entry to a classified trial balance of the general ledger. Both machine and manual methods are blended to provide maximum efficiency in the operation of the unit. For example, in many instances, exceptions appear that cannot be programmed into machine procedures; these exceptions are handled manually. Also, it was brought out that any function that could be performed by one person can be completed more economically by manual methods than by machines. Because of the growth of this company no individual has been eliminated from employment because of machine utilization. The effect of machines has been an increased need for personnel in analytical positions

and has caused a general up-grading of the accounting and clerical jobs in the unit. Integrated-data processing is being studied and in time it is anticipated that all subdivision offices will be connected to this headquarters office, the centralized accounting service unit.

Machine-accounting personnel.--The 18 employees that constitute the staff of this unit have specific job titles and formal job descriptions are used. The job descriptions were not made available to this researcher.

The Unit Manager is a high-school graduate and completed a program of instruction in accounting in a business college. He received his initial training on punched-card machine operation as on-the-job training in a state agency. His total experience includes two years in a state agency, one year in a private business concern, three years in the armed forces, and 11 years in his present position.

The Second Man is a college graduate with a degree in accounting. He received his initial instruction through the local IBM office. His total experience includes several years as a teacher in a business college, two years as the Second Man in another department of this company, and three years in his present position.

The Group Supervisor is a high-school graduate and has completed two years of college. He received his initial instruction on punched-card equipment through a local business college. His total work experience includes eight years

in the employ of this company, four as a Machine Operator and four in his present position.

The Control Clerk is a high-school graduate and received her initial training in key-punch operation on the job with this company. She was employed as a File Clerk and was promoted to her present position, which includes the supervision of the Key-Punch Operators. She has been employed eight years, five in her present position.

In the Machine Operator job classification there are five persons employed, one woman and four men. All of these people are high-school graduates. Two of the five were experienced operators at the time of their employment, the other three were sent to the local IBM office for initial instruction on punched-card equipment. The average length of employment for these five persons is five years.

In the Key-Punch Operator job classification there are seven women. All are high-school graduates and received their initial instruction on punched-card equipment as on-the-job training with this company. Three of the seven individuals have been employed for approximately ten years. The other four have been employed for approximately six years.

The two Clerks are both high-school graduates. They have been in the employ of this company for approximately four years.

Current employment practices.--Sources of personnel:

New employees are hired at the levels in which need is evident. The sources of personnel are promotion from other departments within the company and classified advertising.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. A screening interview is conducted by interviewers in the Industrial Relations Department. The final selection of an individual in this unit is contingent upon the approval of the unit manager. A battery of tests are administered to all prospective employees by personnel in the Industrial Relations Department. Previous employment and character references are considered in the selection procedure. A very rigid physical examination is given. A grade of "A" on the physical examination indicates perfect health. A grade of "B" indicates a correctional defect. Any person given one of these two grades is considered employable.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when a vacancy occurs. Information concerning the salaries for the 18 jobs in the machine-accounting unit was not revealed. The manager did indicate the salaries paid were near those of competing companies. Based on this statement it is assumed that the salaries paid are at least average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personnel trait emphasized in this unit is mechanical aptitude.

Education: A high-school education is required for employment in the machine-accounting unit in this company. It was indicated that there is a preference in supervisory positions for college graduates with fields of concentration in accounting, mathematics, and management. A general high-school program is recommended for machine operators and key-punch operators. Key-punch operators are required to have typewriting ability and be able to type at least 40 words per minute. Machine operators are required to have completed one basic machine course and supervisory personnel must have completed more advanced courses offered by the local IBM office. Key-punch operators are not sent to the IBM school for the key-punch course; the company prefers to train its own key-punch operators while they are on the job.

Experience: Attempts are made to promote from within and train employees for key-punch and machine operator positions as the need arises. However, if employed from outside the company, two years of experience is required of all operators.

In-service education: This company has a rotation training program. Individuals are moved from one machine or job to another until they have learned the total operation.

Lower level clerical workers are given an opportunity to learn punched-card operations through four hours a week of instruction given by the experienced workers.

Machine utilization.--Production: The machines in use and the per cent of time in operation where known are:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (5)	100
Verifier (2)	100
Sorter (3)	--
Collator (3)	--
Accounting (3)	82
Reproducer (3)	--
Interpreter	--
Card-to-tape Converter. . .	--
Tape-to-card Converter. . .	--
Calculator.	35
Computer (medium)	94
Adding-Listing (2)	--
Desk Calculator (2)	--
Typewriter (2)	--

This company also has a Freiden Add-Punch and a Remington-Rand Syncro-Tape machine for preparation of input media for the computer. All tape and punched-card machines are rented for a monthly fee of \$10,500.

Time and Cost savings: A significant savings of time is illustrated in the following statements from the unit manager: "Closing the ledger accounts is now nine days faster than when the machine unit was first installed. The manual, typewritten billing procedures required seven Clerk-Typists, compared to one and one-half Key-Punch Operators to prepare the cards to complete this function on punched-card equipment.

Nothing is programmed for the machine that cannot cut the operational time in half. For example, if a function requiring 100 man hours to complete manually would not be prepared for machine processing unless it could be accomplished in 50 man hours or less." There has been no study to establish a definite dollar amount of savings.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. However, based on the following statement it is assumed that increased accuracy has resulted in definite savings for this company. "There has been a terrific improvement in accuracy; the accounting operation just isn't out of balance anymore. This is because of the internal controls within the punched-card equipment."

Unique problems.--From the standpoint of management, there were no problems that might be directly chargeable to punched-card machine utilization.

Petroleum Producing and Distributing

This case pertains to the operations of the home office of a petroleum producing and distributing company. The organizational structure places responsibility for the operation of the machine-accounting unit with the Secretary-Treasurer; a Supervisor is in direct charge of the unit.

The unit is called the "Tabulating Department." The present machine-accounting department has been in operation approximately ten years. Machines were first installed to fulfill the payroll function.

Of the employees in clerical and accounting jobs 31 are employed in the machine-accounting unit--one supervisor, one assistant supervisor, one chief machine operator, ten machine operators, two programmers, one chief key-punch operator, thirteen key-punch operators, and two file clerks.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs, due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the 10 years the Tabulating Department has been in operation, the number of employees has steadily increased from seven to the 31 persons currently employed. In the opinion of the supervisor, these 31 persons constitute an adequate staff for present operations. It was estimated by the supervisor that 100 additional persons would be required to do manually what is currently done by machines.

It was emphasized that for the past three years, even with utilization of punched-card equipment, overtime was required to such an extent that machine operators could work as many hours as they desired. This was due to increased

business volume. Within recent months an IBM "650" Computer has been installed, completely eliminating any overtime operation.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was largely that of preparation of the payroll. The functions have been expanded to currently include all accounting-data processing for this company. The most recent additions were credit-card accounting and accounting for oil-run payments to leaseholders. In the process of adding the complete accounting procedure to punched-card machines and from this equipment to the medium size computer, no one was eliminated from employment. All persons whose jobs were eliminated were relocated within the company to perform duties for which they were qualified. Normal attrition has made unnecessary any special provisions for persons temporarily not needed during the change-over periods.

Machine-accounting personnel.--The 31 employees that constitute the personnel of this machine-accounting unit have specific job titles, although no attempt has been made to formalize job descriptions.

Information concerning the education, initial training, and experience of each individual was not reported. However, it was stated that the average length of tenure for machine operators was four to five years. In the past two

years there have been only two changes in the 15 machine operator positions. The average tenure for key-punch operators is two years.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need. The source of personnel is through classified advertisements.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. An interview is conducted by the department supervisor who has the responsibility for employing competent individuals for the job classifications in this department. The IBM key-punch and machine aptitude tests are administered to applicants of this department, along with a general intelligence test. Previous employment and character references are used in the selection procedure for each individual seeking employment. An extensive physical examination is given. General good health is the physical status required for individuals seeking employment in the machine-accounting unit.

Promotion and salaries: Promotion is primarily from within and is based on a merit system. An individual is upgraded when the required merit points have been attained for advancement. Information concerning the specific salaries for the 31 jobs in the machine-accounting unit was not reported. The supervisor did indicate the salaries paid

compared favorably with other punched-card machine units of the same type. This indicates that the actual salaries paid are probably above average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized for personnel of this department are alertness, dependability, and congeniality.

Education: A high-school education is required for employment in the machine-accounting unit. No specific courses were recommended. No special machine preparation is required other than experience of the equipment.

Experience: Experience on equipment is required for employment. In this department, attempts are made to insure that both key-punch and machine operators have at least two years of experience.

In-service education: This company at the present time has no planned in-service education program. It was indicated that two years ago a formal training program was attempted. This program was dropped because of the amount of time required to conduct it properly.

Machine utilization.--Production: The machines in use are eleven card punches, five verifiers, five sorters, five collators, eight accounting machines, four reproducers, one interpreter, two calculators, one computer (medium), four adding-listing machines, and one desk calculator. No

records are maintained to show per cent of time in operation of the punched-card machines. The IBM machines are rented for a monthly fee of \$8,000.

Time and cost savings: A significant saving of time was indicated in a statement from the supervisor. However, there has been no study to establish definite dollar amounts or percentage figures. From the major equipment change, that has just been accomplished, it is anticipated that 50 per cent of the time required to complete an accounting function on standard punched-card equipment can be saved through the use of a medium sized computer.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. However, it was indicated that the change to the IBM "650" will show a great improvement in accuracy even over the punched-card procedures. This improvement in accuracy and the improved accuracy of punched-card methods over manual methods should definitely result in savings for this company.

Unique problems.--From the standpoint of management, there were no problems involving personnel that might be directly chargeable to machine processes. Because of the extreme detail required, the accounting staff welcomed machine utilization to relieve the work-load. Normal attrition has made unnecessary any special provision for persons temporarily not needed during the change-over period.

Public Utility

This case pertains to the operations of the home office of a public utilities company. The company was organized in 1928 through a consolidation of several smaller companies. This company supplies natural gas to 65 cities throughout Oklahoma, Kansas and Texas. The gross sales volume is approximately \$12,000,000 per year. There are branch offices located in cities of 1,000 population or over and collectors in cities smaller than 1,000.

The average number of employees is 550. Of this number, 20 are engaged in clerical and accounting jobs and the remaining 530 employees are engaged in service phases of the total operation, some employed in branch offices, and others employed as collectors.

The organizational structure places responsibility for the operation of the machine-accounting unit with the Treasurer; a Supervisor is in direct charge of the unit. The unit is called the "Machine-Accounting Department," a part of the Accounting Department. The present Machine-Accounting Department has been in operation approximately 12 years. Machines were first installed to fulfill the billing function.

Of the 20 employees engaged in clerical and accounting jobs, seven are employed in the machine-accounting unit--one supervisor, two machine operators, three key-punch operators, and a control clerk.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs throughout this company due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the 12 years the machine unit has been in operation, the number of employees has never exceeded seven. In the opinion of the supervisor, the seven persons currently employed constitute an adequate staff for present operations. It was indicated that no estimate could be made concerning the number of additional persons who would be required to do manually what is currently done by machines. The reason for this is that many jobs done on machines would not be done manually. Peak loads are not now a serious problem because of work scheduling to eliminate any that did exist, and to provide for any unforeseen problems. There was very little overtime in the manual system and none at all since machines were installed. Through the use of punched-card methods the local management now receives reports of value that were not even envisioned when manual methods were in use.

Specific accounting functions.--The function at the time of installation was that of customer billing. The functions have been expanded to currently include complete general ledger accounting. This company gradually added

functions, one at a time, as each one became a smooth running operation. The basic reason that a punched-card system was installed was the speed attainable through this method of data processing. As the data processing expanded, it was found that punched-card methods also made it possible to obtain more usable information out of accounting records. It was emphasized that machine utilization is highly adaptable to any job in which there is an extreme amount of detail involved in processing data into usable information. Machine utilization did not cause any decrease in employment, if anything an increase was experienced. At the present time, no further change is contemplated for machine application.

Machine-accounting personnel.--The seven employees who constitute the personnel of this unit have specific job titles although no attempt has been made to formalize job descriptions in this machine unit.

The Supervisor is a college graduate with a degree in business administration. He received his initial training through the IBM Service Bureau. His total experience in punched-card equipment operation includes three and one-half years in the IBM Service Bureau as a machine operator and 12 years in his present position.

In the Machine Operator job classification two persons are employed, one man and one woman. Both of these individuals are high-school graduates and received their

initial instruction on punched-card equipment as on-the-job training in other business concerns. The total experience of the man includes three years as a machine operator in an insurance company in another state and six years in his present position. The experience of the woman includes several years as a key-punch operator in other business concerns, one year as a key-punch operator in this company, and two years in her present position.

In the Key-Punch Operator job classification three women are employed. All three are high-school graduates and received their initial key-punch instruction as on-the-job training, two in other concerns and one with this company. One of the two has been employed for two years, and the other two for one year.

The Control Clerk is a high-school graduate. Her total experience includes approximately five months as a billing-machine operator and 12 years in her present position.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need. The source of personnel for this unit is the Oklahoma State Employment Service.

Selection devices: All persons who seek employment with this company are required to fill out an application blank containing general information. An interview is then

conducted by the department supervisor who also is responsible for selection of competent individuals for this department. References from previous employment are followed-up in the selection procedure for each individual seeking employment.

Promotions and salaries: Promotion is primarily from within, and an individual is up-graded if possible when vacancies occur. Information concerning the specific salaries for the seven jobs in the Machine-Accounting Department was not available. The supervisor did indicate the actual salaries in two positions and the range of salaries in the other two positions.

Supervisor.	\$500
Control Clerk	300
Machine Operator (men).	\$350 to 400
Machine Operator (women).	250 to 300
Key-Punch Operator.	200 to 250

This information indicates that the actual salaries paid are probably average or above average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: No personal traits other than those considered as normal employable traits were emphasized for personnel of this department.

Education: A high-school education is required for employment in this machine-accounting unit. It is the belief of the supervisor that a person in his position should have a college degree. A general high-school program was

recommended. No special machine preparation is required other than experience in the operation of punched-card equipment.

Experience: Experience in the operation of punched-card equipment is required for employment as machine operators. Attempts are made to insure that machine operators have at least two years of experience. If a person is hired, or promoted into a key-punch position, who does not have experience as a key-punch operator, he is sent to the local IBM key-punch course.

In-service education: No planned in-service education is in effect. In several instances, as a need arises, operators are sent to the local IBM office for specific machine instruction.

Machine utilization.--**Production:** The machines in use and the percentages of time in operation for the punched-card equipment are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (4)	70
Verifier	70
Sorter (3)	70
Collator	70
Accounting (3)	75
Reproducer	70
Interpreter	70
Calculator	50
Adding-Listing (2)	--
Desk Calculator	--
Typewriter	--

The monthly rental for the IBM machines is \$2,500.

Case No. 31

Time and cost savings: A significant saving of time was indicated but there has been no study to establish definite dollar amounts or percentages on the savings. It was emphasized that availability of more information was considered more important than time savings.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy.

Unique problems.--The main problem encountered in relation to the machine unit was machine down-time that would not be encountered in a manual system. This is partially overcome through periodic preventive maintenance conducted by customer service engineers of the machine manufacturer.

Case No. 32

Public Utility

This case pertains to the operations of the home office of a public utility company. The company was organized in 1903 and its early activities included both gas and electric service to cities in Oklahoma. In 1927 the gas distribution facilities were sold and the company concentrated on the distribution of electrical service. The services have been expanded to include several cities in Arkansas. At the time of the case report 265 cities were

serviced, 330,000 customers were billed on an end-of-the-month basis and 3,900,000 on a monthly billing cycle basis. There are eight divisions and 24 districts in the operational area of this company.

The average number of employees is 2,700. Of this number, 1,000 are employed in the plant facilities and 1,700 are engaged in clerical and accounting jobs. Of these 1,700 employes, 300 are located in the home office.

The organizational structure places responsibility for the operation of the machine-accounting unit with the general auditor, who in turn is responsible to the treasurer; a supervisor is in direct charge of the unit. The unit is called the "IBM Department." The present IBM Department has been in operation approximately ten years. Machines were first installed to fulfill the billing function. Of the 300 employees in clerical and accounting jobs within the company, 35 are employed in the machine-accounting unit--one supervisor, one operations supervisor, one senior clerk, seven machine operators A, five machine operators B, eight key-punch operators, five clerks, and seven junior clerks.

Machine-accounting operation.--There has been a steady increase in the number of employees engaged in clerical and accounting jobs due to increased business volume. The use of machines has continuously expanded the amount of work accomplished in maintaining proper accounting operations.

In the 10 years the machine-accounting unit has been in operation, the number of employees has steadily increased from 10 to 35. In the opinion of the supervisor, the 35 persons currently employed constitute an adequate staff for present operations. The supervisor related that at one time an extensive personnel study was started to evaluate the effectiveness of punched-card procedures compared to manual procedures. It was found that a typist could complete 1,200 billings per day. In the 20 working days per month, approximately 177 girls would be required to prepare the monthly billing of 4,230,000 separate accounts. The IBM Department performs this billing function and many others with only 35 persons. The personnel study then was dropped as it was felt that it would be of no value in improving the accounting operation.

In the manual system, a peak period representing 65 per cent of the accounting processing load was experienced during the first ten days of each month. Through the use of machines, operations are programmed so that no peak periods are required in any of the accounting functions. No overtime has been required since the machine operation started. This is true because of efficient scheduling of the machine work load. With the punched-card methods, the local management now receives reports of value that were not even envisioned when manual methods were in use.

Specific accounting functions.--The functions of this machine-accounting department at the time of installation were billing of accounts receivable, preparation of payroll, and inventory control. The functions have been expanded to currently include accounting for accounts receivable, which includes cash posting. This became an added function when it was determined that the work could be accomplished more rapidly and with less expense than by other means. At the time the IBM Department took over this function, it was possible to transfer 16 accounts-receivable clerks to other departments within the company, because of the reduced manual effort required. The use of punched-card equipment has in several instances done away with clerical jobs but at no time have the machines ever replaced an employee. At the time the machines were installed, the reinstatement of a no-marriage rule reduced the clerical staff by six individuals, which allowed for balancing out of a portion of the reduced clerical need. Business volume had increased to a point where costs of manual methods were becoming prohibitive.

At the present time it is anticipated that dividend accounting, dividend check writing, and subsidiary ledger accounting will soon be added to the functions of this unit. By adding these functions, a contract firm which has been performing the functions will be eliminated. The basic philosophy of machine utilization has been the elimination of jobs but not of people.

Machine-accounting personnel.--The 35 employees that constitute the personnel of this department have specific job titles although no attempt has been made to formalize their job descriptions.

The Supervisor is a high-school graduate. His source of initial training on punched-card equipment was the local IBM customer service school. His total experience includes 22 years in the employ of this company. He was initially employed as a junior clerk in the accounting department and was promoted to his present position at the time the machines were installed. He has held this position for 10 years.

The Operations Supervisor is a high-school graduate. His source of initial training was the local IBM office. He was employed as a meter reader and was promoted through the accounting department to his present position. He has been employed for 22 years, 10 years as Operations Supervisor.

The Senior Clerk is a high-school graduate and received his initial instruction on punched-card equipment through the local IBM office. He has been employed for 11 years. His first employment classification was that of Mail Clerk in the accounting department. He has been employed in his present position for nine years.

In the Machine Operator A job classification seven men are employed. These men are all high-school graduates, two of the seven have completed college and two have

completed approximately three years of college work. Their initial instruction on punched-card equipment for the most part has been on-the-job training; one or two have attended the local IBM customer service courses. Two of the seven were initially employed as meter readers, the other five as junior clerks in the accounting department. The range in employment time is from five to 13 years and the average length of employment is 10 years. The time in their present positions ranges from one year to nine years and the average is approximately four years.

In the Machine Operator B job classification five men are employed. These five persons are all high-school graduates and one completed a business college program. The source of initial instruction in punched-card machine operation was through on-the-job training. Four of the five men were employed as trainees, the other one as a service man in the service department. The range in employment is from one to five years and the average length of employment is approximately two and one-half years. The time in their present position ranges from one year to three years and the average length of time in their present position is approximately two years.

In the Key-Punch Operator job classification eight women are employed. These eight women are all high-school graduates and received their initial instruction on the

key-punch machine as on-the-job training. All were initially employed junior clerks during their training period. The range in employment is from one to five years and the average length of employment is approximately three years.

In the Clerk job classification five women are employed. They are all high-school graduates, one of the five is a college graduate and another one has completed a business college program. Machine knowledge is not required in this position. Their range of employment is from one to eight years and the average length of employment is four years.

In the Junior Clerk job classification seven persons are employed. These seven women are all high-school graduates. They have all been employed within the year, ranging from two to six months. The average length of employment for these seven persons is approximately three and one-half months.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need after all promotion possibilities have been exhausted. The main source of personnel for this unit is other departments within the company. If no one is interested in being transferred into the machine-accounting unit any other possible source of prospective employees is used.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. A screening interview is then conducted by a personnel clerk. The final selection of an individual is contingent upon the approval of the department supervisor. Previous employment and character references are requested and are followed-up, for each individual seeking employment. An extensive physical examination is given. Two physical requirements were emphasized: the ability to stand, and a very stable nervous system. These two items are considered because all machine operators work in a standing position and because of the noise this work is very nerve racking.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when vacancies occur. Information concerning the specific salaries for the 35 jobs in the machine-accounting department was not available. The supervisor did indicate the range of salaries in four of the positions to be:

Senior Clerk.	\$347 to \$465
Machine Operator.	217 to 413
Key-Punch Operator.	217 to 291
Clerk	217 to 327

No information relative to the supervisor's salary was stated because of company policy. The range in salaries reported for this IBM Department indicates the actual salaries paid are probably above average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: No specific personal traits were emphasized for personnel of this machine unit other than the physical requirements noted previously.

Education: A high-school education is required for employment. Typewriting ability is a necessity for the key-punch operators with training in accounting recommended for machine operators. No special machine preparation is required; however, the company encourages special machine preparation by providing company time to those who wish to attend the local IBM machine courses.

Experience: Experience on punched-card equipment is not required for employment. Attempts are made to promote individuals from other departments within the company into both machine operator and key-punch operator positions. The 10 individuals who helped to start this department were all promoted from the accounting department.

In-service education: This company has no planned in-service education program. Management trainees are given a complete schooling on the machine operation through a rotation plan. In the machine-accounting department, every month each person is shifted from one job to another job so that every six months he makes a complete rotation of all jobs performed.

Machine utilization.--Production: The machines in use and the per cent of time in operation for each machine are:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (14)	70
Verifier (3)	68
Sorter (4)	87
Collator (2)	62
Accounting (8)	85
Reproducer (6)	70
Calculator (2)	60
Interpreter (3)	60
Typewriter	10
Burster	80
Power Cutter	5
De-collator	5

The monthly rental for the IBM machines was not reported.

Time and cost savings: No significant saving of time was indicated because of the balancing factor of increased volume. It was reported that about the same amount of actual time is required to complete the billing function by machines as was required to complete this function by manual methods. This is true because of the enormous increase in volume of accounts processed now compared with the volume when manual methods were in use. A study to establish a per unit cost was made and the following unit cost saving was found--3.7 cents per bill. Under manual methods the unit cost was 7.5 cents per bill, with punched-card machine methods 3.8 cents per bill.

Case No. 32

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. It was emphasized that a very significant improvement was noticeable. The supervisor estimated that at least a 30 per cent improvement in accuracy was experienced because of the mechanical proof possible with punched-card equipment.

Unique problems.--The supervisor stated that the main problem encountered in changing from manual methods to machine methods was that of gaining acceptance for machine operation from both management and workers. It was emphasized that in order to make the change-over from manual to machine methods, all individuals concerned should be well informed on the reasons for such a change and the benefits that can be derived from machine utilization. It is the belief of the machine-accounting personnel that if such a procedure had been followed the problem of acceptance would not have been encountered. As it was, with no ground work, it took over seven of the ten years that machines have been utilized to overcome the ill feelings toward the machine-accounting unit.

Case No. 33

Public Utility

This case pertains to the operation of an area office of a public utility company providing communications service

to Oklahoma City and the state of Oklahoma. This organization became a part of a national communications system in 1919 when a local company affiliated with the present controlling company. There are five area offices in the whole system reporting to the home office in St. Louis, Missouri. The general accounting policies are formulated in the home office accounting department. There are two districts that are subdivisions of this area office. The gross income is approximately \$48,000,000 per year.

The average number of employees is 8,024. Of this number, 435 are employed in the accounting department. The remaining 7,589 employees are engaged in the commercial, engineering, plant, and traffic phases of the total operation.

The organizational structure places responsibility for the operation of the machine-accounting unit with the division accounting manager, a machine manager is in direct charge of the unit. The unit is called the "Machine-Accounting Operation." The present Machine Accounting Operation is in the process of reorganization. Two separate punched-card machine-accounting units are being combined. One unit, in operation two years, was installed to perform the payroll function. The other unit has been in operation one year, and was installed to perform the revenue billing function. There is also a punched-card machine unit that is utilized

by the Traffic Control Group. This unit will not be considered in the analysis of data for this study as the functions performed are not accounting in nature.

Of the 435 employees in the accounting department, 28 are employed in the Machine-Accounting Operation--one manager, one supervisor, two tabulating equipment supervisors, one key-punch supervisor, six machine operators, seven key-punch operators, one machine technician, four record clerks, and five mail clerks.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs, due to the use of machines. Machine utilization has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. The number of individuals in the machine-accounting unit has increased from four in the original unit to 28. In the opinion of the manager, the 28 persons currently employed constitute an adequate staff for present operations.

To meet any peak work load operation, extra punched-card equipment is held in reserve. This procedure is considered to be more economical than to require personnel to work overtime to process peak operational loads.

Specific accounting functions.--The functions of the original machine accounting units were payroll preparation

and revenue billing. The combined units are in the process of adding customer billing to the functions performed. In adding this function no decrease in the number of persons employed was required. Any individuals whose jobs were eliminated were transferred to other jobs for which they were qualified. Any overstaffing is being compensated for by normal attrition.

At the present time, it is anticipated that property inventory and cost accounting will be added to the functions of this unit. In adding these functions it is thought that seven more individuals will be required in the machine-accounting organization as key-punch or machine operators. Also, it is estimated that 15 clerical positions will be eliminated. The eight persons making up the difference between the additional needs of the machine unit will be re-located in other jobs in the company. It was emphasized that these functions are considered as fringe operations. If property inventory control and cost accounting were the only functions for machine utilization, punched-card equipment would not have been installed. The performance of these functions required excessive manual work even with machines.

Machine-accounting personnel.--The 28 employees who constitute the personnel of this machine-accounting unit have specific job titles and each position has a formal job description.

Machine-Accounting Manager.--Reports to the Division Accounting Manager. Has full responsibility for programming, processing, planning, developing, installation, personnel, inter-department relations, new applications, and advancing new techniques and equipment for the data processing activities of the company.

Accounting Office Supervisor.--Reports to the Machine-Accounting Manager. Is responsible for all operations of punched-card equipment, organization, supervision, personnel, planning, performing, controlling and internal scheduling, and work standards and performance of the machine-accounting organization.

Tabulating Equipment Supervisor.--Reports to the Accounting Office Supervisor. Has complete supervision of the operations of punched-card equipment, including key-punch operations, related work of operators, trains new operators, advises on mechanical matters, and work schedules.

Tabulating Equipment Operator.--Operates a machine that automatically analyzes, makes calculations and translates or divides information represented by holes punched in groups of tabulating cards, and prints the translated data on form sheets, reports, special cards, or accounting records. Sets or adjusts machine to add, subtract, multiply, and make other calculations. May operate auxiliary machines.

Key-Punch Machine Operator.--Records accounting and statistical data in tabulating cards by punching a series of holes in specified sequence, using a key-punch machine. May operate a verifying machine.

Records Clerk.--Performs duties of simple or repetitive nature such as sorting, posting, checking, copying, and addressing envelopes. Duties performed require little previous experience and a minimum of judgment. May do some typing.

Mail Clerk.--Processes incoming and outgoing mail. May operate related machines and equipment and perform other minor office duties.

Information concerning the education, initial training, and experience of each individual was not reported for

any of the employees of this unit other than that of the manager and the accounting office supervisor.

The Machine-Accounting Manager is a college graduate with a degree in accounting. He received his initial instruction on punched-card equipment as on-the-job training with this company. He was initially employed as a college trainee. He has been employed for seven years, one month in his present position.

The Accounting Office Supervisor is a college graduate with a degree in accounting. He received his initial instruction on punched-card equipment as on-the-job training with this company. He was initially employed as a college trainee. He has been employed for four years, one year in his present position.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the job level in which there is a need. The sources of personnel are other departments within the company, referred individuals, and any other source if necessary.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. An interview is conducted in the central employment office by a personnel clerk. The final selection of an individual is contingent upon the approval of the machine-accounting manager. The IBM key-punch and machine

aptitude tests are used. Each individual is given an intelligence test and a general aptitude test. All clerical applicants are given a typewriting proficiency test. References from previous employment are used in the selection procedure for each individual seeking employment. An extensive physical examination is required. Any physical defect causing back trouble would eliminate an applicant from employment.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when vacancies occur. Information concerning the specific salaries for the 28 jobs in the machine accounting division was not available. The manager did indicate the range of salaries in four positions to be:

Machine Operator.	\$53.50 to \$76.00
Key-Punch Operator.	51.50 to 74.00
Records Clerk	51.50 to 74.00
Mail Clerk.	50.50 to 71.50

No information relative to supervisory salaries was stated, because of company policy. The range in salaries reported for this machine-accounting unit indicates that probably the actual salaries paid are average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized are ability to work under pressure, flexibility in thinking, and a mechanical inclination.

Education: A high-school education is required for employment. Typewriting ability is a necessity for key-punch operators. No special machine preparation is required for employment.

Experience: Experience on equipment is not required for employment. In this unit, attempts are made to bring individuals into the unit who have company experience rather than punched-card machine experience. All machine operators must have had key-punch operating experience.

In-service education: This company has no planned in-service education program. Individuals are sent to the local IBM office for training when there is a need. All key-punch operators are sent to the key-punch operators course prior to actual key-punch production work. Supervisors also conduct a constant on-the-job program of specific job instructions.

Machine utilization.--Production: Even though the two original units are combined, production is still considered in two separate units. The per cent of time in operation is based on operational records on which the operational time of each machine is recorded to the nearest six-minute interval. The machines in use and the per cent of time in operation are:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Payroll Unit:	
Card Punch (9)	34
Verifier (5)	25
Sorter	24
Collator	44
Accounting (2)	35
Reproducer	35
Interpreter.	44
Calculator	57
Billing Unit:	
Card Punch	71
Verifier	70
Sorter	100
Collator	104
Accounting (3)	90
Reproducer	56
Interpreter.	80

All IBM machines are rented for a monthly fee of \$6,197.

Other office machines in use include adding-listing machines, typewriters, and a systematic coupler.

Time and cost savings: A significant saving of time was indicated in a statement from the manager. There has been no study to establish definite dollar amounts or percentage figures. It was estimated that machine operations would be two to three days ahead of a manual operation if performed simultaneously.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. However, it was emphasized that machine processing was much more accurate.

Case No. 33

Unique problems.--The manager indicated that the main problems encountered in this machine-accounting unit were:

(1) fear of loss of jobs by accounting and clerical personnel, (2) lack of space for proper housing of punched-card equipment, and (3) difficulty in getting machine operators, because the jobs in the machine unit require so much physical stamina. In this company only women are employed in the operator positions.

Case No. 34

Office Service Bureau

This case pertains to the operations of a private office service bureau utilizing punched-card equipment exclusively. The company was organized in 1955 by a Certified Public Accountant, a system expert, and a punched-card machine expert. The type of work performed by this company includes both complete processing of accounting records and over-load operations for other companies utilizing IBM punched-card equipment.

The average number of employees is nine. Of this number, six are employed in the machine room and three are considered general office employees--one sales and two clerical. The organizational structure places responsibility for the operation of the machine-accounting unit with the president; a supervisor is in direct charge of the unit.

The unit is called the "Machine Room," referred to as the "Production Department." The present production department has been in operation three years. Machines were first installed to fulfill a private service bureau function.

The six employees in the production phase are the president, one supervisor, two machine operators, and two key-punch operators. Several part-time key-punch operators are utilized on special jobs as needed.

Machine-accounting operation.--Because of the nature of this unit the variation in numbers of employees would be reflected in the clients' operations. It was related that in several companies reductions in personnel did take place; however, in most instances the use of the service bureau has not replaced employees. Through re-scheduling work in each company normal attrition takes care of any over employment. In the opinion of the president, the six persons currently employed in this service bureau constitute an adequate staff for present operations except for special peak work periods that are difficult to plan for because of the nature of the operation. During these peak work periods extra key-punch operators are added. It was estimated that between 40 and 60 additional persons would be required to do manually the volume of work currently accomplished by the machines of this office service bureau.

The clients serviced by this organization are divided between business concerns that do not have machine-accounting units of their own and those that do. Seventy-five per cent do not have units; 25 per cent do, using this company for over-load operations more economically than by adding machines or personnel to their units or utilizing over-time.

Specific accounting functions.--The function of this unit is the providing of office service to other business concerns. The work performed for clients includes: sales analysis, billing of accounts receivable, preparation of payrolls, addressing, accounting for accounts receivable, accounting for accounts payable, handling of personnel records, general ledger accounting, and so forth. The functions performed for clients that do have punched-card installations include: handling of work over-loads, working with confidential payrolls, and card punching for card-a-tape installations. The experiences of the clients of this office service bureau vary in regard to effect on personnel. In some instances, clients were able to make reductions in their accounting and clerical staffs by using the services of the bureau. It was emphasized that such experience was the exception and the general procedure involved merely re-scheduling of work rather than discharging of individuals because of a reduction in clerical burden. Normal attrition provided for reductions considered mandatory.

At the present time, it is anticipated that a mailing service will be added to the functions performed by this office service bureau. This service will include addressing, stuffing, and sealing of envelopes. Address files will be maintained on punched cards.

Machine-Accounting Personnel.--The six employees that constitute the production personnel have specific job titles although no attempt has been made to formalize their job descriptions.

The President is a high-school graduate and has completed most of the work for a college degree in engineering. He received his initial training on punched-card equipment with the Oklahoma Tax Commission. His total experience includes eight years in accounting and fourteen years in punched-card equipment operations. This person is one of the original members of this office service bureau and has been its president for three years.

The Machine Room Supervisor is a high-school graduate and received his instruction on punched-card equipment as on-the-job training with the Oklahoma Tax Commission. His total experience includes eight years with the Commission, two years with the Oklahoma City Board of Education, and one and one-half years in his present position.

In the Machine Operator job classification two persons are employed, one man and one woman. Both of these people

are high-school graduates, and the woman has completed two years of college. These two individuals received their initial instruction on punched-card equipment as on-the-job training, the woman in a business concern, the man while employed at Tinker Field. The total experience of the woman includes eight years in other business concerns as a key-punch and machine operator. She has been in her present position for two years. The man had eight years of experience as a machine operator at Tinker Field and has been employed in his present position for two years.

In the Key-Punch Operator job classification two women are employed. Both are high-school graduates and both received their initial instruction in key-punch machines while employed at Tinker Field. These women each had approximately seven years of key-punch experience when they were employed. One of the two has been employed for one and one-half years and the other for one year.

Current Employment practices.--Sources of personnel:

New employees are hired for office jobs at the levels in which there is need. The sources of personnel for this unit are contacts with machine-accounting supervisors in other business concerns and advertisements in the local papers.

Selection devices: All persons who seek employment are interviewed by the president and vice president. The final selection of an individual is contingent upon the

approval of both officers. The IBM aptitude test for key-punch operators and an oral test for machine operators are used. The oral test consists of questions developed by the president to indicate a person's actual knowledge of the punched-card machines used in the unit. Previous employment and character references are used in the selection procedure.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when a vacancy occurs. The following salaries in the six positions in the unit were revealed.

President.. . . .	\$750
Salesman.	750
Machine Room Supervisor . .	500
Machine Operator.	350
Key-Punch Operator.	300
Clerk	225

The president, salesman, and machine room supervisor as officers of the company also share in any profits. The salaries reported for this unit are above those revealed in the NOMA salary survey.

Qualifications of employees.--Personal traits: The supervisory personnel in this unit must be able to take criticism graciously and tend to be extroverts. Machine operators must be congenial. Key-punch operators should be introverts, because of the extreme monotony involved in their work.

Education: A high-school education is required for employment in this unit. College courses in accounting are

required for supervisory personnel. Accounting principles, statistics, and physics were indicated as desirable courses for machine operators. Typewriting ability is a necessity for the key-punch operators and courses in business mathematics and rapid calculation are recommended. It is the belief of the president that on-the-job training and experience are much better than formal instruction as preparation for machine operations.

Experience: Experience on equipment is required for employment. Attempts are made to insure that machine operators have at least three years of experience. It was pointed out that a definite experience requirement is hard to determine for key-punch personnel because of the relative simplicity of the operation. The amount of experience needed to qualify a person as a good key-punch operator varies to a great extent.

In-service education: No planned in-service education program is conducted. Informal instruction is given to machine operators as needed. On occasion, machine operators are sent to the IBM office for special instruction.

Machine utilization.--Production: The machines in use and the percentages of time in operation where known are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (12)	30
Verifier (2)	--
Sorter (2)	60
Collator	80
Accounting Machine (2)	70
Reproducer	70
Interpreter	30
Calculator	30
Tape-To-Card Converter	10
Adding-Listing	--
Desk Calculator	--
Typewriter (2)	--

The IBM machines are rented for a monthly fee of \$2,200. Machine utilization in this unit differs from that in other installations because machines must be available for any kind of job request.

Time and cost savings: Because of the nature of this operation no time and cost savings are experienced in the unit. The clients of this concern have indicated that they have savings, but no studies have been made to establish the amounts. Several clients have reported that they have cut time off of manual operations by being able to extend closing dates for billing customers.

Accuracy factor: The effect of the machine operation on accuracy is also unique because of the nature of the work. The measurement of the accuracy of the operation depends on the extent of the control data and the accuracy of source documents provided by the clients. Several clients have

conducted studies relative to improvement in accuracy. They have reported complete elimination of errors of calculation and extensions. This has meant savings of from 10 to 70 per cent for the companies using this private office service bureau.

Unique problems.--It was indicated that the main problem encountered by a machine service bureau is that of public relations. Businessmen have no conception of what a machine service bureau can do and the effect it can have on their accounting clerical burden. Reluctance on the part of management to let anyone else know what is going on has been encountered by this bureau. It was emphasized that doing work for a business concern in which there is internal dissention is a real problem at times. This problem extends into both the selling and performing of the service rendered by this bureau.

Office Service Bureau

This case pertains to the operation of a private office service bureau utilizing Remington-Rand punched-card equipment. The service was originated in 1950 as a public accounting office. Shortly after organization, the owner purchased the franchise for the western half of Oklahoma, in a nation-wide bookkeeping service that used Remington-Rand

punched-card systems of accounting. The nation-wide organization no longer exists; however, this accounting firm retained the name of the national organization. The concern, at present, has nine clients for whom complete accounting records are kept.

The number of employees in this organization is three: one accountant, one machine operator, and one clerk typist. This is a single proprietorship type of business, all employees are responsible to the owner. Because of the nature of this case, there is no specific machine-accounting unit since the entire operation revolves around the punched-card machines. The present installation has been in existence approximately eight years. The machines were installed to fulfill the needs of the general public for accounting service.

Machine-accounting operation.--There has been a decrease in the number of employees engaged in this office service bureau from six to three. This decrease was not attributed to machine utilization, but to a decrease in the number of clients serviced. In the eight years this concern has been in operation, there has been only one machine operator. This one person is adequate for the work involved. It was estimated that 10 persons would be required to do manually what is currently done by machines.

Specific accounting functions.--The function of this machine-accounting installation is that of public accounting.

The operation includes the same type of general accounting done by other public accountants, the difference being that in this concern punched-card equipment is utilized. It was emphasized that in only one instance was any reduction in personnel brought about through utilization of the office service bureau in a client's operation. One client stated that he was able to discharge two accountants out of four, and that the fee paid to the service bureau was smaller than the salary expense.

Machine-accounting personnel.--The one person that operates the equipment in this installation has a specific job title but no attempt has been made to formalize the description of his job.

The Machine Operator is a high-school graduate and received his initial instruction on punched-card equipment as on-the-job training with this concern. He has also completed several correspondence courses in accounting. His total experience includes seven and one-half years as an employee of this office service bureau.

Current employment practices.--A discussion of employment practices in terms of sources of personnel, selection devices, and promotion is not applicable to this case report. No change has occurred nor is anticipated in the one machine position. The salary of the machine operator is \$300 per month.

Qualifications of employees.--Personal traits: The personal trait emphasized is mechanical inclination.

Education: It was reported that a high-school education should be required for employment in all machine-accounting positions. Formal education in accounting and mathematics is considered a must for machine operators. No special machine preparation is recommended until some experience on the equipment has been obtained.

Experience: Experience on punched-card equipment need not be a requirement for employment.

Machine utilization.--Production: The machines in use are: a card punch, a sorter, an accounting machine, and a reproducer. No records are kept to indicate per cent of time in operation for any of the machines. The Remington-Rand machines used in this office service bureau have been purchased. It should be noted that this is the only installation of punched-card machines represented in this study that has purchased the equipment it uses.

Time and cost savings: It was indicated that the machine-prepared financial reports are turned out much more rapidly than could be done by manual methods.

Accuracy factor: There are no records kept by any clients to indicate whether there have been significant improvements in accuracy.

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Unique problems.--The main problem indicated was one resulting from the extensive speed in the processing of data with machines. It was related that in some instances reports have to be held for a day or two after they have been completed. This is true because clients cannot understand the speed attainable in data processing. Clients tend to question the fees charged because of the shortness of the time required to prepare financial reports by machine as compared to the manner in which they are prepared manually by other public accounting firms.

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Common Carrier

This case pertains to the operations of the home office of a common carrier of automobiles. This company includes three separate automobile transport subsidiaries operating throughout the United States. Major terminals are located in Michigan, Arizona, Texas, Tennessee, and Missouri. One subsidiary unit contracts with Chrysler Corporation for distribution of its automobiles. The other two subsidiaries are carriers for Buick, Oldsmobile, and Pontiac Divisions of the General Motors Corporation; one operating out of Kansas City, Missouri, and the other out of Arlington, Texas. The three combined units operate 1,000 tractors and 1,500 trailers in the transportation of automobiles to dealers throughout the country. The average yearly gross income from

the operations of the three units is between \$20,000,000 and \$25,000,000.

The average number of employees engaged in clerical and accounting jobs in this company is 100. Of this number, 40 are employed in the various terminals and 60 are employed in the home office operation in Oklahoma City.

The organizational structure places responsibility for the operation of the machine-accounting unit with the controller; a supervisor is in direct charge of the unit. The unit is called the "Tabulating Department." The Tabulating Department has been in operation for six years. Machines were first installed to fulfill the revenue accounting function. The original machine installation included all the machines in operation at the present time with the exception of one tabulator which was added because of an increased volume of data processing. Of the 60 employees in clerical and accounting jobs, five are employed in the Tabulating Department--one tabulating supervisor, one general machine operator, and three key-punch operators.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical jobs. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. Personnel employed in jobs that were eliminated because of the utilization of punched-card

equipment have been transferred to other positions which they were qualified to fill. In the six years the Tabulating Department has been in operation, the number of employees has never exceeded five. In the opinion of the supervisor, the five persons currently employed constitute an adequate staff for present operations.

It was estimated by the supervisor that 20 or more additional persons would be required to do manually what is currently done by machines. This assumption is based on the fact that many jobs that are processed by machine would not be done manually. It was further indicated, that to accomplish only the necessities, two additional employees would be required.

In this automobile transport company, closing the books and preparation of financial reports are accomplished within eight days after the close of each accounting period. It is the consensus of the supervisor of the Tabulating Department and other personnel that this would require an additional week if the accounting machines were not available. The preparation of financial statements and payroll are considered as peak-load operations. The payroll is prepared twice monthly and would require two additional days if prepared by manual methods. At the present time no overtime is required. With installation of machine methods, 12 hours of overtime were eliminated each pay period. Through the use

of punched-card methods, management now receives reports of value that were not even envisioned when manual "pen-and-ink" methods were in use.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was revenue accounting. The functions have been expanded to include all accounting except the general ledger. In assuming the various accounting functions, change in responsibility was the basic effect on personnel. At the time preparation of the payroll was changed to the tabulating equipment, four payroll clerical jobs and two bookkeeping machines were eliminated. Of the four persons involved, two were transferred to other departments and two, both bookkeeping-machine operators, were discharged because their training was so limited that they were no longer employable in this office.

The reason for the change to tabulating equipment was speed gained both in operations and in obtaining data for required reports. Through the utilization of machines, it is possible to carry out a daily billing process rather than accumulating charges for a periodic billing. Because of the nature of this company, a common carrier of automobiles, regular reports and information are required by the Interstate Commerce Commission. It was indicated that information, in the form of operational statements, is

required weekly for hearings on territorial rights involving this company. The reports and statements prepared on punched-card equipment present the information in good form along with more current statistics than could be done with manual methods and statistics based on estimates.

At the present time, it is anticipated that this company will make an equipment change which will further speed up the accounting functions performed by the Tabulating Department. The equipment change will make it possible for operational reports to be in the hands of management by noon of the first of each month.

Machine-accounting personnel.--The five employees who constitute the personnel of this department have specific job titles but no attempt has been made to formalize job descriptions.

The Tabulating Supervisor responsible for the fulfillment of the functions of this department has been employed for three and one-half years as the Tabulating Supervisor. He is a high-school graduate. His initial training on punched-card equipment involved on-the-job training while employed by Douglass Aircraft Corporation in Oklahoma City during World War II. Between 1945 and 1951 this person had extensive experience in punched-card accounting as a machine operator both in public and private accounting. He was the Tabulation Supervisor in the Tulsa office of Douglass Aircraft Corporation from 1951 to 1953.

The General Machine Operator was employed as a machine trainee and has been with this company for three months. His source of initial training was on-the-job training in the company. He is a high-school graduate and has had two years of college work. He has had no previous experience on punched-card equipment.

In the Key-Punch Operator job classification three persons are employed. All three of these women are high-school graduates and all received their initial instruction in key-punch operation as on-the-job training, two with this company and the other one in a governmental agency on IBM equipment. One of the three individuals has been employed for three and one-half years, the other two are new employees having been employed within three months of the time of this case report.

Current employment practices.--Sources of Personnel: New employees are hired for office jobs at the job level in which there is a need. The main sources of personnel, to fill key-punch and tabulating machine operators' positions, are private employment agencies. The source for supervisory personnel is the local Remington-Rand office.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. A personal interview is then conducted by the Tabulating Department Supervisor, who approves the

individual for employment. References from previous employment are asked for on the application blank but are not used to any extent in the selection process.

Promotion and salaries: Because of the size of this department there is no specific promotional sequence to higher level jobs other than from a trainee to a specific operator. The information concerning the specific salaries for the jobs in this unit was not available. The supervisor did indicate that the starting salary for a tabulating machine operator is \$275 for inexperienced personnel, and ranges from \$350 to \$400 for personnel with one and one-half years' experience. The starting salary for key-punch operator-trainee is \$250, and the range is between \$275 and \$325 for experienced operators. No information relative to the supervisor's salary was available because of company policy. The range in salaries reported indicates that probably the actual salaries paid are above average when compared with the information revealed by the salary survey made by NOMA for 1958 of Oklahoma City.

Qualifications of employees.--Personal traits: The personal traits emphasized for a person who would supervise a tabulating department are: drive (never satisfied with just getting a job done), ability to criticize (thoroughly scrutinize everything pertaining to accounting, never taking anything for granted), a good imagination, and a thorough

understanding of terminology of the business in which he is working. The tabulator operator should be mechanically inclined, inquisitive, and energetic. The key-punch operators should have the ability to concentrate on what they are doing and be able to sit for a long period at a time. It was the opinion of the supervisor that any person who enjoys typewriting would find double enjoyment in a key-punch position.

Education: No minimum number of years of education is required for employment; however, all the employees are at least high-school graduates. No specific courses were indicated as requirements for employment. Typewriting was suggested for persons desiring to become key-punch operators since it would speed up the learning of the key-punch operation. It was indicated that "experience was the best teacher," and that on-the-job training takes precedent over specific machine courses. It was the opinion of the supervisor that in many cases the person who has a degree in accounting is so inbred with basic accounting theory that it is impossible for him to see basic machine applications and ramifications.

Experience: Experience on equipment is not required for employment in this company's machine unit.

In-service education: This company does not have an in-service education program as such; however, each employee regardless of experience must go through a three-month

training period prior to permanent employment. This policy is practiced because of the variances in operations from unit to unit. The three-month period gives the employer and employee time to make sure each individual employed will fit the job.

Machine utilization.--Production: The machines in use and the per cent of time of operation are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Verifying Punch (3)	70
Sorter	60
Collating-Reproducing Punch	60
Tabulating Machine (2)	85
Interpreter	30
Summary Punch	15

This is a Remington-Rand installation. The monthly rental for the machines is \$1,260. The machine rental is charged as an overhead item in the General Expense control account.

Time and cost savings: A significant saving of time was indicated but there has been no study to establish any definite dollar amounts or percentages of the savings. It was indicated that the over-all cost, comparing manual and machine methods, was approximately the same. Savings result from the ability of the machines to provide more data and the speed with which accounting information is processed. Under manual methods, it took approximately twenty days to prepare the operating reports for the three units of the

company. With punched-card equipment, this was cut to eight or nine days.

Accuracy factor: There were no records to indicate whether there was any significant improvement in accuracy. However, based on the statements of the supervisor, it is assumed that increased accuracy has meant definite savings. The supervisor stated that his machine-accounting operation was 99.9 per cent perfect. He related that one of the company's customers made a check on billings for a period of three months and could not find even a minor error. He also indicated that transposition errors common in manual operations were eliminated in the punched-card method of processing accounting information.

Unique problems.--Space utilization was indicated as the major problem in this company in relation to the machine unit. The supervisor stated that in planning for a machine room the square footage considered as the maximum space needed should be multiplied by two to provide for expansion of operations. Educating accountants to the importance of machines and their operational scope was related as a general problem unique to the field of punched-card accounting.

Common Carrier

This case pertains to the operations of the home office of a motor freight common carrier. The company was organized 25 years ago and provides motor freight service in Oklahoma, Kansas, Texas, Missouri, Illinois, and New Mexico. During the past year 1,035 million pounds of freight was handled. The gross income is between \$13,000,000 and \$14,000,000 per year. There are 25 branch offices considered major stations and 100 considered minor stations in the major cities of the six states serviced.

The average number of employees is 1,100. Of this number, 450 are engaged in clerical and accounting jobs, and the remaining 650 employees are engaged as drivers and maintenance employees.

The organizational structure places responsibility for the operation of the machine-accounting unit with the office manager; a lead operator is in direct charge of the operation of the accounting machines, and a supervisor of key-punching is in direct charge of all key-punch operators. The unit is called the "Tab Room." The Tab Room has been in operation approximately two and one-half years. Machines were first installed to fulfill the freight-revenue accounting function.

Of the 450 employees in clerical and accounting jobs, approximately 350 are located in branch offices and 100 in

the home office. Of this number, 11 are employed in the machine-accounting operation; one lead machine operator, one assistant machine operator, one supervisor of key-punch operators, five key-punch operators, one verifier operator, one control clerk, and one file clerk. The latter individual's time is considered to be one-half machine unit and one-half general office.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. Their use has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the two and one-half years the machine-accounting unit has been in operation, the number of employees has never exceeded 11. The 11 persons currently employed constitute an adequate staff for present operations. No overtime is required of the machine-accounting personnel. In this operation a work schedule is maintained; if the person assigned to a specific task cannot complete it, other employees are assigned to assist that person in order to maintain the work schedule. No estimate was ventured concerning the number of additional persons who would be required to do manually what is currently done by machines. Machine methods have eliminated peak periods, through proper scheduling of the work performed by each individual.

Prior to the actual installation of punched-card equipment, a two-year period was spent in preliminary planning to ready the company for a change-over from manual methods to machine methods. This made it possible to switch from a manual system to a punched-card system without one "hitch" in operations of any sort.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was freight revenue accounting. The functions have been expanded to include preparation of the payroll and mileage statistics. Preparation of the payroll was added when it became apparent that the extensive clerical burden in the manual preparation of the payroll could be drastically reduced with the machines available. At the present time, an equipment change is anticipated that will increase the operational efficiency of this unit. A "604" calculator will be installed to allow calculations to be performed by machines and the results punched into cards within the machine. This will cause a decrease in payroll jobs. It is thought that individuals whose jobs are eliminated will be shifted into other positions in which they are qualified. In some instances accounting employees will be relieved of routine clerical tasks required in payroll preparation to do higher level accounting work.

Machine-accounting personnel.--Of the 11 employees who constitute the personnel of the unit, two are men and nine are women. Under the present organization of this unit the following job descriptions are those established.

Lead Machine Operator.--Utilizes IBM equipment such as type 402 Accounting Machine, type 419 Accounting Machine, type 077 Collator, type 514 Reproducer, type 552 Interpreter, and type 082 Sorter, on highly technical flow charts to prepare and process the following:

- Freight bill registers
- Tonnage and revenue reports
- Station debit and credit listings
- Summary cards for tonnage and revenue
- Cash report listings for the local office director
- Interprets freight bills and cash reports cards
- Monthly tonnage and revenue reports by station
- Monthly C.O.D. listings
- Payroll distributions reports
- Commodity listing report by station
- Monthly power listing
- Quarterly summary payroll report
- Payroll checks
- Weekly cash reports listings by station
- Adjusted freight bill registers.

At times wires panels for various jobs and maintains flow charts on various operations performed.
Reports directly to the Manager of Offices.

Assistant Machine Operator.--Utilizes IBM equipment such as type 402 Accounting Machine, type 419 Accounting Machine, type 077 Collator, type 514 Reproducer, type 552 Interpreter, and type 082 Sorter, in assisting the Lead Machine Operator in preparing and processing the accounting functions listed.

At times assists the Lead Machine Operator in the wiring of panels for various jobs and helps maintain flow charts on various operators performed.
Reports directly to the Lead Machine Operator.

Supervisor of Key-Punch Operators.--Operates IBM Key-Punch machine cutting cards from general office forwarded copy on the freight bills and from cash reports listings, re-cuts corrected cards for those

rejected by the verifier. Re-cuts cards on which audit department has found miscellaneous errors on first and second freight bill register check. At times, cuts cards from drivers' trip tickets for mileage breakdown, cuts cards for posting direct receivables collected by the Oklahoma City terminal, cuts cards for payroll checks. Cuts cards from adjustment sheet and cuts cards from freight bill amendments. Exercises partial supervision over six IBM key-punch operators and reports directly to the Manager of Offices.

IBM Key-Punch Operator.--Operates IBM Key-Punch machines cutting cards from general office forwarded copy of the freight bills and from cash report listings. At times cuts cards from freight bill amendments and cuts cards from drivers' tickets for mileage breakdown reports. Reports directly to the IBM Key-Punch Supervisor.

Alphameric Key-Punch Operator, operates IBM Key-Punch Machine (alphameric) cutting cards from general office forwarded copy of the freight bills and from cash report listings. Cuts IBM cards from all weekly, semi-monthly, and petty cash payrolls. At times cuts cards for equipment listings and mailing lists. Reports directly to the IBM Key-Punch Operator Supervisor.

Verifier, IBM Key-Punch Operator.--Operates IBM Key-Punch Machines (verifier) verifying IBM cards cut by other operators covering freight bills corrections, driver trip tickets, and mileage reports. At times, operates IBM Key-Punch Machine. Reports directly to the IBM Key-Punch Operator Supervisor.

IBM Key-Punch Operator and File Clerk.--Files general office copies of freight bills, i.e., delivery receipts and general office forwarded copies. Operates IBM Key-Punch Machine, cutting IBM cards from cash report listings (credit postings only). At times makes photostats of freight bills using Verifax. Reports directly to the IBM Key-Punch Operator Supervisor.

No information was reported concerning the education, initial training, and experience for each individual in this

machine-accounting unit. The Office Manager did indicate that all were high-school graduates and were transferred into the machine-accounting department from other departments within the company.

Current employment practices.--Sources of personnel: New employees are hired for clerical office jobs when there is a need. The source of personnel for this unit is through promotion, of persons, within the company, who indicate an interest in machine work.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. An interview is then conducted by a personnel clerk. The final selection of an individual for this unit is contingent upon the approval of the Office Manager. A four-hour battery of tests is administered to all employees. The test battery includes measurement of personality, vocational interest, and general aptitude. Employees interested in machine work are sent to the local IBM office for further testing of machine aptitude. Periodically the SRA Employment Inventory is administered by a management engineering concern from Chicago. A thorough check of past experience is conducted of previous employment references, character references, and police record--including finger printing. No physical examination is required of key-punch operators. Machine operators are required to undergo a complete physical examination, including a back X-ray.

Promotion and salaries: Promotion is primarily from within and an individual is up-graded if possible when vacancies occur. Information concerning the specific salaries for the 11 jobs in the machine-accounting unit was not available. It was indicated that the average salaries were--Lead Operator \$450, Machine Operator \$400, and Key-Punch Operators \$320. The clerical employees' salaries also average \$320. The average salaries reported indicate that actual salaries paid are probably above average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: The personal traits emphasized are congeniality and ability for routine work. The testing program results are used to indicate whether or not a person possesses these traits.

Education: A high-school education is required for employment. Typewriting and 10-key adding-listing machine operational skills are helpful for the key-punch operators, with mathematics recommended for machine operators. Special machine preparation is required on the equipment that each individual operates. This preparation is obtained through attending the local IBM courses.

Experience: Experience with the company is a requisite for employment in the machine-accounting unit.

In-service education: This company sends individuals to the local IBM classes as their in-service education

program. Each individual is sent to special machine classes to learn the operation or as refresher training.

Machine utilization.--Production: The machines in use and the percentages of time in operation are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (5)	100
Verifier.	100
Sorter (2)	77
Collator.	77
Accounting.	77
Reproducer.	77
Interpreter	77

The IBM machines are rented for a monthly fee of \$1,550.

Time and cost savings: A significant saving of time was indicated in statements from the office manager. To illustrate, "Prior to machine utilization, the Profit and Loss Statement could not be completed before the 25th or 26th of each month; after machines were installed this statement is completed by the 10th. Overtime operations in accounting data processing were eliminated." There has been no study to establish definite dollar amounts or percentage figures.

Accuracy factor: There are no records kept to indicate whether there has been a significant improvement in accuracy. Based on the statements that follow it is assumed that increased accuracy has resulted in definite savings for this company. "Since machine installation was effected,

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there are very few errors compared to many. In manual operations there was no verification of data."

Unique problems.--The office manager indicated that there were no problems encountered in changing from "pen-and-ink" methods to machine methods because of the extensive preparation conducted by this company prior to machine utilization.

Case No. 38

Banking

This case concerns the machine-accounting unit of a bank. The bank was chartered in 1918 and in the late 1920's merged for the first time with another bank, retaining the original name which the bank operates under today. Other mergers with smaller banks have taken place since that time making this case subject one of the largest banks in the State of Oklahoma. This organization has played a vital role in the development of Oklahoma City and all of its varied economic activities. It has been a leader in the banking field in the state. At the time this case study was made, the deposits amounted to approximately \$140,000,000.

The organizational structure places the responsibility of the machine-accounting unit under the Purchasing Agent of the bank who in turn is directly responsible to the Cashier, a staff officer. The actual operation of the unit is under the control of only one person. The unit is called the

"Tabulating Department." It has been in operation for four years. Machines were originally installed to provide a needed system for the maintenance of records for securities held in safe keeping.

The total average number of employees is 275. Of this number, 27 are officers of the Bank. Because of the nature of this case, the remaining 248 employees are considered to be engaged in clerical and accounting jobs. Of the 248 employees one person is employed in the Tabulating Department--the machine operator. The Purchasing Agent who is in charge of this unit is not considered a part of the machine-accounting unit. His relationship to the unit is administrative rather than actual supervision of work.

Machine-accounting operation.--In the four years the Tabulating Department has been in operation, the one operator has been the only person employed in this department. Two girls who are employed in the Safe-Keeping Department are trained on the key-punch and other equipment; they have in some instances helped in the processing of data in this unit. In the opinion of the Purchasing Agent, the one person currently employed constitutes an adequate staff for present operations.

There is a peak period of operation in this department each Thursday; however, no overtime is required. It was indicated that without the punched-card equipment the reports

prepared would require overtime for the Safe-Keeping Department. It was estimated that one or two additional persons would be required to do manually what is currently done by machines.

Specific accounting functions.--The function of this machine-accounting unit at the time of installation was the maintenance of records for securities held in safe keeping for other banks and a limited number of individuals. The functions have been expanded to include safe deposit box inventory, physical inventory of furniture and fixtures, accounting for a pension trust (for a customer of the bank), and writing dividend checks. The basis for change to machine methods from manual methods in carrying out these accounting functions was the time required to prepare the necessary reports for the customer and management. Also the machine methods decrease the time and problems involved in balancing out the accounts that are processed on machines, which is of prime importance to this type of business activity. A unique reason for the use of punched-card equipment was the prestige benefits gained from the appearance of the reports to customer banks.

There has been no decrease in personnel because of the use of machines; in fact, because of increased volume in the departments effected, an increase in personnel has been required. At the present time, it is anticipated that there

will be a need for the addition of a key-punch operator because of an expansion of the current functions of this department. There is a possibility that the dividend checks are to be changed to a quarterly pay period and the pension trust, which has been dormant, is to become active.

Machine-accounting personnel.--The individual who constitutes the personnel of this department does not have a specific job title nor a formal description of her specific duties. For this case write-up, she will be classified as a general machine operator.

The General Machine Operator responsible for the fulfillment of the functions of this department has been employed with this bank for four years. She is a high-school graduate and had no previous business experience of any kind. Her initial training on punched-card equipment was through the classes conducted by the local IBM office.

Current employment practices.--The employment practices discussed are based on the current policies of this banking operation as they would involve any new employee if there were a need for operators in this machine-accounting unit.

Sources of personnel: The source of personnel for this punched-card installation would be through the IBM office.

Selection devices: All persons who seek employment are required to fill out two application blanks--a preliminary (short form) blank for general information, and a formal application for specific placement information. An interview is conducted by an individual in the personnel department. The Wonderlick Aptitude Test is administered to all applicants for employment by the personnel department. References from previous employment and references of character are used in the selection process.

Promotion and salaries: Because this installation is unique, promotion is not pertinent to this specific case. The information concerning the salary for the individual in this department was not available because of bank policy.

Qualifications of employees.--The qualifications of employees described are those that would be considered ideal for a machine unit of this size and scope.

Personal traits: The one personal trait emphasized for personnel of this type of work was emotional maturity.

Education: A high-school education is considered to be of value but in this banking operation there are no minimum educational requirements. It was indicated that a person who plans to work in the area of punched-card accounting should have at least average intelligence. A person to do what the individual does in this tabulation department should have attended the key-punch operators' class, basic machine

operators' class, and the class on the accounting machine to be used.

Experience: Experience on equipment is not necessary for employment, in this specific operation.

In-service education: No in-service education program as such is conducted. The operator was sent to the local IBM school at the time of employment. It was indicated that this practice would prevail if other persons were added to the department.

Machine utilization.--Production: The machines in use in this unit are as follows: Card Punch, Sorter, and Accounting Machine. No record is kept to show a percentage of operational time.

Time and cost savings: A significant saving of time was indicated but there has been no study to establish any definite dollar amount or percentage figure of savings. A comparison of the machine method with manual method was expressed as "minutes over days."

Accuracy factor: There are no records kept to indicate whether there was any significant improvement in accuracy. However, because of the ease in balancing at the end of each day's operation, it is assumed that accuracy has meant a definite savings for this bank.

Unique problems.--It was indicated that there were no specific problems which could be attributed to the use of

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machines. Other departments show no envy or jealousy, because of a dislike for change from their present systems and procedures.

Case No. 39

Banking

This case pertains to the operations of a bank. The first charter of this bank dates back to 1889. Since that time, several banks have merged to form the present banking operations. This bank started using its present name in 1930 and the final merger took place in 1948. This bank is one of the leaders in the banking field in the southwest, serving customers in Oklahoma City, throughout the state, and the southwest United States. The bank has \$240,000,000 in demand deposits.

The average number of employees of this bank is 400. Of this number, 350 are engaged in clerical and accounting jobs, and the remaining 50 employees are staff personnel engaged in various phases of the total operation. The organizational structure places responsibility for the operation of the machine-accounting unit with the controller; a manager is in direct charge of the unit. The unit is called the "Tabulating Department," referred to informally as the "Tab Department." The present department has been in operation two and one-half years. Machines were first intalled to fulfill trust accounting functions. Of the 350 employees in

clerical and accounting jobs, six are employed in the machine-accounting unit: one manager, one machine supervisor, two machine operators, and two key-punch operators.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs, due to the use of machines. Their use has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the two and one-half years the machine-accounting unit has been in operation, the number of employees has never exceeded six. The six currently employed constitute an adequate staff for present operations. It was the opinion of the manager that it would be impossible to estimate the number of additional employees required to do manually what is currently done with machines. Through machine utilization, many secretaries have been relieved of clerk-typist duties required of them under the manual system. They now do work of a nature that is more valuable to the total banking operation.

The same year-end peak loads experienced when the manual system was used are present with the machine methods. Overtime is handled in a similar fashion. Under manual methods, if an operation was requiring overtime, another person was employed to complete the job within the regular working day. With machine methods, if a job requires overtime,

the individuals that constitute the machine-accounting staff are divided into two shifts, each working a regular eight-hour day, and the machines are operated overtime.

Specific accounting functions.--The function of this department at the time of the installation of the machines was trust accounting. The functions have been expanded to include preparation of the payroll and additional elements of the trust operation. Preparation of the payroll became an added function when it was determined that through the use of punched-card procedures tax reporting and check writing could be simplified to a great degree with less expense than by other means. There was no reduction in personnel when the machine-accounting department took over this function.

At the present time, installment loan accounting is in the planning stages for machine application. It is thought that adding of this function will require increasing the staff by one or two persons. It is also assumed that the change may result in less need for workers in the present installment loan department but no people will be released. Normal attrition is expected to absorb any excess in personnel needs.

Machine-accounting personnel.--The six employees that constitute the personnel of this department have specific job titles although no attempt has been made to formalize the descriptions of their jobs.

The Tabulating Department Manager was initially employed to set up, develop procedures, and manage this department. He is a college graduate with a degree in accounting. His knowledge of punched-card equipment was obtained on the job in one of the state agencies. His total experience includes six years of machine work in a state agency, as an operator and supervisor, and two and one-half years in his present position.

The Machine Supervisor is a high-school graduate. Her source of initial training was on-the-job training with this bank. Her total experience includes five and one-half years in other departments of the bank and two and one-half years as the supervisor of this department.

In the Machine Operator job classification two men are employed. Both are high-school graduates. One of the two received his initial instruction on punched-card equipment in the Armed Forces, the other as on-the-job training in another business concern. The total experience of one of the two includes two and one-half years in the Armed Forces and four months in his present position; the other one and one-half years in another business concern and only several days in his present position.

In the Key-Punch Operator job classification two women are employed, both high-school graduates. The source of initial key-punch training was unknown for one operator

and the other received her initial training on-the-job.

Both were experienced key-punch operators.. One of the two has been employed for one and one-half years and the other one for six months.

Current employment practices.--Sources of personnel:

New employees are hired for office jobs at the job level in which there is a need. The main source of personnel for this department is the local IBM office.

Selection devices: In the selection procedure for other departments, all persons who seek employment are required to fill out an application blank for general information; however, for persons employed in the tabulating department the application blank is completed after employment for the personnel department files. An interview is conducted by the Manager of the tabulation department with the final selection of an individual contingent upon the approval of the Controller who also acts in the capacity of a personnel manager. The IBM key-punch and machine aptitude tests are administered to all applicants for jobs in this unit. References from previous employment as well as character references are used in the selection procedure for each individual seeking employment.

Promotion and salaries:--Promotion is primarily from within and an individual is up-graded if possible when vacancies occur. Information concerning the specific salaries

for the six jobs in the tabulating department was not available. The manager did indicate the range of salaries in two of the positions to be:

Machine Operator.	\$275 to \$375
Key-punch Operator.	225 to 300

The range in salaries reported for this machine-accounting unit indicates that probably the actual salaries paid are above average as compared with salaries revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits:

Normal employable traits with an emphasis on mechanical aptitude was indicated for personnel of this department. The manager indicated that a person in his position should possess the ability to analyze a manual function to the point that he might visualize the machine application and procedure. He also stated that men as a general rule seem to "pick-up" machine operation faster than women.

Education: A high-school education is required for employment in the machine-accounting department. Typewriting ability is a necessity for the key-punch operator, with instruction in accounting recommended for machine operators. It is also recommended that the manager have a degree in accounting and that machine operators have college level education. No special machine preparation is required other than experience on the equipment. However, it is recommended

that key-punch operators attend the key-punch operator school conducted by the local IBM office.

Experience: Experience on equipment is required for employment. In this department, attempts are made, and it is considered ideal, to employ key-punch operators who have had at least six months of experience, and machine operators with one year of experience.

In-service education: This bank has no planned in-service education program. If experienced personnel cannot be found, new employees are sent to the classes conducted by the local IBM office as in-service education.

Machine utilization.--Production: The machines in use are: two card punches, one verifier, one sorter, one collator, one accounting machine, one interpreter, one reproducer, one adding-listing machine, and one typewriter. No records are kept to show a percentage of time in operation other than for the key-punch machines. These two machines are in operation 90 per cent of the eight-hour operational day. The IBM machines are rented for a monthly fee of \$1,100.

Time and cost savings: A significant saving of time was indicated in statements from the department manager. For example, he stated that customer statements are prepared faster than under manual methods and that the payroll was much faster. There has been no study to establish definite

dollar amounts or percentage figures. No decrease in time-lag in reports was experienced for the reason that in this operation it is the belief of management that any dead line can be met if compilation of information starts soon enough. The time savings would come then from a decrease in the time to accumulate data for a given report.

Accuracy factor: Because of the type of business of this case report, accuracy is not a significant factor. All procedures, regardless of the method used are checked and double checked, as no errors are acceptable.

Unique problems.--It was indicated that the main problems encountered in changing to machine methods were the usual confusion of change and a lack of knowledge about the equipment. This was overcome by providing information which described the equipment and its utilization. A problem unique to this machine-accounting unit was that of "selling" the machine methods to various departments of the bank where the utilization of this equipment would benefit the accounting function. This machine-accounting unit is organized to operate as a service bureau within the bank. At the present, the departmentalized service charges are relatively high, because of the newness of the unit. Through a "go-slow" policy of selling the effects and benefits that may be derived from machine utilization, it is hoped that eventually more and more accounting data processing will be added. This will

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allow the cost to be spread over more departments, so that definite dollar savings will be realized for each department.

Case No. 40

Theater

This case concerns the operations of the home office of a company operating motion picture theaters. One hundred seventy theaters are operated in Oklahoma, Texas, and New Mexico. The various theaters send their daily reports to the home office for processing, both ticket sales and concessions. This operation started in 1926. The original company, due to financial difficulties, was taken over in 1949 by the present owners. Recently, a subsidiary company was organized to provide community television antenna service to fringe-area viewers. The volume of business is \$8,500,000 per year in ticket and concessions sales.

The average number of employees of this home office operation is 90. Of this number, one-half are in clerical and accounting jobs, the other half are engaged in staff operations and in the distributive phases of the total operation. The organizational structure places the responsibilities of the machine-accounting unit with the secretary-treasurer; the chief accountant is in direct charge of the unit. The unit is the "IBM Department," a part of the accounting department. The IBM Department has been in

operation for ten years. Machines were first installed for payment of film rental and to distribute to the various theaters their shares of rental expenses.

Of the 45 employees in clerical and accounting jobs, six are employed in the IBM Department: one chief accountant, one chief operator, one machine operator--trainee, and three key-punch operators.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. The use of machines has continuously expanded the amount of work accomplished, but at no time has a machine ever replaced an employee. In the ten years the unit has been in operation, the number of employees has never exceeded six. The six persons currently employed constitute an adequate staff for present operations except for approximately 18 hours of overtime required of the chief accountant in scheduling work and analyzing results of the machine operation. No estimate was made concerning the number of additional persons that would be required to do manually what is now done with the machines. The peak operational period is right after the first of each month and requires no overtime operation by any of the machine operators.

Specific accounting functions.--The function of this unit at the time of installation was the payment of film

rental and distribution of this charge to the various theaters under the control of the company. The functions have been expanded to include the complete accounting system other than inventory control and accounting for fixed assets. It is not anticipated that these functions will be added because of the adequacy of the present manual method of control of these items. Also the billing function of the antenna service was added at the time this subsidiary company was formed. When the machine-accounting department took over the payroll function, it was possible to transfer two payroll clerks to the department as key-punch operators. This change caused some feeling of resentment on the part of the employees involved, but it did not present any major personnel problem. Normal attrition has always taken care of any possibility of discharging personnel because of the use of automatic equipment. At the present time there are no anticipated changes in the functions of this department. However, an increase in work load is expected because of an increase in the volume of business of the subsidiary company.

Machine-accounting personnel.--The six employees that constitute the personnel of this department have specific job titles but no attempt has been made to formalize the descriptions of their jobs.

The Chief Accountant responsible for the fulfillment of the functions of this department has been employed by the

company for thirty years, and has been in this department (from its beginning) ten years. This person was initially employed as an usher in one of the theaters and worked up through the ranks to theater manager prior to coming into the home office accounting department as a chief operator. He has been the chief accountant for one year. He is a college graduate with a degree in accounting. His initial instruction on punched-card equipment was in machine-accounting classes in college.

The Chief Operator is a college graduate and her source of initial training was through on-the-job programs with this company and the local IBM class in basic machine operation. Her total experience includes one year as a key-punch operator, six years as a machine operator, and one year in her present position.

The Machine Operator--Trainee is a high-school graduate and received her initial training as on-the-job preparation in another business concern. Her total experience includes one year as a key-punch operator with this company and two months in her present training status.

In the Key-Punch Operator job classification there are three women. All three persons are high-school graduates. Two of them received their initial key-punch training as on-the-job training in other companies and the other one through the local IBM office. One of the three has been employed

for one year, one for eight months, and the other one for three months.

The length of employment for the key-punch operators does not depict a typical turnover for this company. The previous key-punch operators were employed for approximately five years each.

Current employment practices.--Sources of personnel:

New employees or transfers come into this department as key-punch operators. The sources of personnel are state and private employment agencies, the IBM office, and unsolicited applications.

Selection devices: All persons who seek employment are required to fill out application blanks for general information. Personal interviews are conducted by the personnel manager and the chief accountant. The chief accountant makes the selection decisions for placement of individuals in this machine-accounting unit. References from previous employment and character references are used in the selection process.

Promotion and salaries: As a general policy, promotion is from within when vacancies occur. For example, no new employees are hired as machine operators. If individuals in one of the theaters want to come into the home office, they are brought in if a position is available for which they can qualify. Information concerning the specific

salaries for the jobs in this unit was not made available. It was indicated that the salaries were near average for the kind of work involved.

Qualifications of employees.--Personal traits: The personal traits emphasized were reliability and compatibility.

Education: There are no specific educational requirements for employment with this company. It was stated that an accounting background is essential for the chief accountant and the chief operator and that a degree in accounting is desirable for the chief accountant. However, the degree as such is not considered essential. Special machine preparation through the basic machine operator's course and the function wiring course as offered by IBM were indicated as requirements for chief operators. No specific preparation was mentioned for key-punch operators.

Experience: Experience on punched-card equipment is not a requirement for employment.

In-service education: No in-service education program exists as such. Key-punch operators are encouraged to learn how to operate the other equipment in the department, as time permits, from the machine operators. If possible, employees are occasionally sent to the local IBM schools for training on specific machines in the unit.

Machine utilization.--Production: The machines in use and the percentages of time in operation are as follows:

<u>Machine</u>	<u>Per Cent of Time in Operation</u>
Card Punch (3)	75
Verifier	80
Sorter	40
Collator	20
Accounting (2)	60
Interpreter.	15
Reproducer	15

The IBM machines are rented for a monthly rental of \$1,480.

Time and cost savings: A significant saving of time was indicated but there has been no study to establish any definite dollar amount or percentage figure. The listing operation on the accounting machine is much faster than typewriting. It saves time in the audit procedure. It was reported that prior to the machine installation it was the 20th of each month before a profit and loss statement could be completed; now it is completed each month by the 10th.

Accuracy factor: There are no records kept to indicate whether there is any significant improvement in accuracy. It was stated, however, that through the use of machines a degree of human error is eliminated which probably means a saving in money for the company.

Unique problems.--No major problems in relation to the use of machines were indicated. The officers of the company, however, who were not directly connected with the accounting phases of the operation, at first found it difficult to justify the increased cost of operations.

Publishing

This case involves the machine-accounting unit of a newspaper publishing company, compiling, printing, and distributing morning and evening daily papers and a Sunday edition. This publishing company was established in 1889 and has grown to be one of the leaders in its field in Oklahoma and surrounding states. The circulation at the time of the interview was 147,500 for the morning paper, 112,300 for the evening paper, and 239,000 for the Sunday edition.

The average number of employees is 750. There are 20 employees engaged in accounting jobs, and the remaining 730 employees are reporters, advertising personnel, press room workers, and administrative personnel. The organizational structure places responsibility for the operation of the machine-accounting unit with the Assistant Manager of the Accounting Department. A supervisor is in direct charge of the unit. The unit is considered as a part of the Accounting Department and has been in operation for approximately 10 years. The machines were installed to improve accuracy and to provide the speed required to process data so that it would have immediate usefulness.

Of the 20 employees in accounting jobs, seven are employed in the machine-accounting unit--one supervisor, two machine operators, two key-punch operators and two verifier operators.

Machine-accounting operation.--There has been little or no variation in the number of employees engaged in clerical and accounting jobs due to the use of machines. The use of machines has continuously expanded the amount of work accomplished but at no time has a machine ever replaced an employee. In the 10 years the punched-card operation has been in existence, the number of employees has never exceeded seven. The seven persons currently employed are not considered adequate for present operations. It was indicated that to be adequately staffed one more key-punch operator and one more machine operator would be required. This would eliminate the overtime necessary in the present operation. It would also relieve the supervisor from routine machine operations so that he could devote time to new applications. It was estimated that 20 additional persons would be required to do manually what is currently done by machines. Peak loads in machine operations are experienced at the first of each month at the time of monthly billings. This requires overtime on the part of one machine operator. Compared with manual methods when overtime was required for four clerical personnel, the monthly billing operation has been improved through the use of machine methods.

Specific accounting functions.--The functions of this machine-accounting unit at the time of installation included payroll preparation, general accounting, and billing of

accounts receivable. The general accounting function included preparation of the operating statement, trial balance, and budget. The billing function included both circulation billing and advertising billing.

The basic reasons for installing machines were for speed and accuracy. Through the use of machines, this concern has been able to prepare the payroll on the same day the period ends. Statements which include one complete month's billing, rather than using a cut-off date, are prepared. As the machine operation became highly efficient, the following functions were added: inventory control and a portion of the accounting for several subsidiary companies of this publishing company. Adding these functions caused no reduction in clerical and accounting personnel, although the amount of clerical detail was reduced extensively. At the present time, no other functions are being considered for this unit.

Machine-accounting personnel.--The seven employees who constitute the personnel of this unit have specific job titles, but no attempt has been made to formalize job descriptions.

The Machine Accounting Supervisor responsible for the fulfillment of the functions of this unit has been employed for ten years and has been in his present position four years. He is a high-school graduate and has completed

two years of college. His knowledge of punched-card equipment was obtained on the job with this company. He was sent to Cleveland, Ohio, for supervisors' training prior to his promotion. The actual work experience of this individual includes seven years as a machine operator and three years as supervisor.

In the Machine Operator job classification two men are employed. Both are high-school graduates and one of the two has completed two years of college. These two men received their initial instruction on punched-card equipment through on-the-job training and the local IBM office. One of the two has been employed for four years, two years as an accounting clerk and two years in his present position; the other of the two has been employed for seven years, three years as a clerk in the advertising department and four years in his present position.

In the Key-Punch Operator job classification two women are employed. Both are high-school graduates and received their initial key-punch instruction as on-the-job training. Both were experienced operators with several years of experience in other business concerns. Both have been employed approximately one year.

In the Verifier Operator job classification two women are employed. Both are high-school graduates and received their initial training in key-punch operations as

on-the-job training. One of the two had several years of key-punch operator experience at the time of her employment. She has been employed for four years as a verifier operator; the other woman has been employed four years, two and one-half as a key-punch operator and one and one-half in her present position.

Current employment practices.--Sources of personnel:

New employees are hired for office jobs at the job level in which there is a need. Personnel for this department have been employed from the following sources: classified advertisements and promotion of clerical workers from other departments.

Selection devices: All persons who seek employment are required to fill out an application blank for general information. Interviews are then conducted by the personnel manager, who screens employees, and the machine-accounting supervisor, who gives final approval for hiring. Both references from previous employment and character references are investigated in the selection process. A physical examination is required of all persons seeking employment. It was indicated that loss of sight, limb, or other such physical handicap could eliminate persons from employment.

Promotion and salaries: The following promotional sequence prevails when possible and if qualified personnel are available: from key-punch operator to verifier operator,

and from verifier operator to machine operator. Information concerning the specific salaries for the seven jobs in the machine-accounting unit was not available because of company policy. The supervisor did indicate that the salaries paid compare favorably with the average salaries indicated in the information revealed by the NOMA salary survey.

Qualifications of employees.--Personal traits: No specific personal traits were emphasized other than what are considered employable traits in any type of office work.

Education: There is no minimum school requirement, although all persons employed are at least high-school graduates. There are no specific course requirements for any of the jobs; however, a knowledge of accounting and mathematics would be an asset for machine operators. It was indicated that key-punch operators should have attained a speed of at least 30 words per minute in typewriting.

Experience: Experience on equipment is not required for employment as machine operators. The present policy is to hire only experienced key-punch operators.

In-service education: This company has no formal in-service education program. It is the practice to send personnel to classes conducted by the local IBM office, when possible, to up-date their knowledge of punched-card equipment. It was indicated that at least six months' experience should precede any formal instruction in the operation of punched-card equipment.

Machine utilization.--Production: The machines in use in this installation are: three card punches, two sorters, one verifier, one collator, one accounting machine, one interpreter, one reproducer, and one calculator. The IBM machines rental cost was not reported for this unit.

Time and cost savings: A significant saving of time was indicated, but there has been no study to establish any definite dollar amounts or percentage figures. It was indicated that manual billing procedures had to be carried on daily throughout the month. They are completed in five days with the use of punched-card equipment.

Accuracy factor: There are no records to indicate whether there is any significant improvement in accuracy. It is the opinion of the supervisor that machine utilization has caused a definite improvement in accuracy in the accounting records.

Unique problems.--The specific problem, considered unique because of machine operation, was that the change in billing procedure made it difficult to give daily balances, if a customer requested a daily balance, compared to manual methods. It was also indicated that a normal feeling against change was experienced. This was quickly overcome when it was found that detailed information was made available, which could not have been prepared manually because of time and cost.

Oil Field Service

This case pertains to the operations of the machine-accounting unit of a drilling mud sales and service company. The company was organized in 1943 as a partnership, incorporating in 1946 to form the present company servicing twenty mid-continent states. The Oklahoma City office is the home office. Branch offices are located in Wichita, Kansas, Fort Worth and Midland, Texas, Denver, Colorado, and Casper, Wyoming. To perform the oil-field drilling-mud sales and service operation 33 trucks, 110 cars, 3 airplanes and 3 boats are maintained. An item of interest, that indicated another phase of automation, is the manufacture and distribution of an electronic drilling device developed by the engineers of this company. This item is distributed over the same territory as their other oil-field service, plus Canada and offshore oil-producing locations. The annual sales volume is \$5,000,000.

The average number of employees of this company is 190. Of this number, 30 are engaged in clerical and accounting jobs, 75 are engaged in warehouse jobs and 35 are engaged as engineers. The organizational structure places responsibility for the operation of the machine-accounting unit with the Office Manager who is in turn responsible to the Secretary-Treasurer. A machine room supervisor is directly responsible for the operation of the punched-card equipment. The unit is

not considered as a machine unit in itself, but merely as a tool to carry out the functions of the accounting department. Punched-card equipment has been utilized for six years. Machines were first installed to fulfill the billing function and the preparation of mud cost reports for customers.

Of the 30 employees in clerical and accounting jobs, two are employed in the machine room--a machine room supervisor and a machine operator.

Machine-accounting operation.--Clerical and accounting personnel have increased in numbers from 18, prior to the installation of machines, to 30 at the present time. This increase in total number of clerical and accounting personnel was due to increased business volume. The number of accounts serviced increased from 600 to 3,000. The use of machines has continuously expanded the amount of work accomplished but at no time has a machine ever replaced an employee. In the six years the punched-card equipment has been in operation, the number of employees has never exceeded three. At the time the case study was completed, the oil industry was suffering a slight recession and this company reduced its office staff to a minimum and still maintained operational efficiency. It was indicated that for normal operations the two persons employed in the machine-accounting unit would not be adequate. It was the opinion of the supervisor that for normal operation, three additional

persons would be required to complete the functions of this unit in a regular working day--one key-punch operator, one machine operator, and one control clerk. Under the present curtailed staff, any overtime operation is taken care of by dividing the personnel and operating in two shifts. No man overtime is required but there is frequent machine overtime. It was estimated that 10 additional persons would be required to do manually what is currently done with the machines.

Specific accounting functions.--The functions of this unit at the time of installation were stock records, billing, sales analysis and cost reports to customers. The basic reasons for installing machines were related to speed and accuracy. The functions have been expanded to include: expense analysis, accounts payable check writing, and preparation of the payroll. These functions were added when it became apparent that they could be processed more economically by the available punched-card equipment than by any other methods. At the present time, no other functions are to be added to the operations of this machine-accounting unit.

Machine-accounting personnel.--The two employees that constitute the personnel of this unit have specific job titles but no attempt has been made to formalize the descriptions of their jobs.

The Machine Room Supervisor responsible for the fulfillment of the functions of this unit has been employed for

six years in his present position. This person is a high-school graduate and has attended night school and completed correspondence courses in accounting subjects. His knowledge of punched-card equipment was obtained while in the Armed Forces. His total punched-card machine experience includes one year as a machine operator in the Armed Forces, three years as a machine-trainee in an oil company, and the six years in his present position.

The Machine Operator is a high-school graduate and received his initial instruction on punched-card equipment as on-the-job training. His total experience includes one and one-half years as a machine operator in another company and eight months in his present position.

Current employment practices.--Sources of personnel: New employees are hired for office jobs at the levels in which there are needs. The sources of personnel for this unit are private employment agencies, Remington-Rand, and on occasion contacts with other units in other companies.

Selection devices: All persons who seek employment are required to complete application blanks for general information. The supervisor interviews all applicants for machine work and makes the final employment decisions. A physical examination is required.

Promotion and salaries: Promotion is limited to advancement in pay levels because of the limited number of

employees in the unit. Information concerning the salaries paid in this unit was not revealed.

Qualifications of employees.--Personal traits: The personal traits emphasized were ability to get along with people and ability to remain calm at all times.

Education: The minimum school requirement is high-school graduation. There are no specific course requirements for any of the jobs. It was stated that a high-school book-keeping course might be an asset to employees in this type of work.

Experience: Experience on equipment as required here is limited to an acquaintance with the punched-card machines. It was indicated that if possible persons who are employed are those who have had at least six months' experience on the machines in other business concerns.

In-service education: The in-service education program is on-the-job instruction under the direction of the supervisor. On occasion, persons have been sent to the local Remington-Rand office for a limited amount of specialized instruction.

Machine utilization.--Production: The machines in use are as follows: card punch, sorter, collating-reproducer, two syncro-matic (typewriter-to-card) machines, and one accounting machine. No records are kept to indicate the per cent of the operational time these machines are used. It was

indicated that 75 per cent of the top speed of the machines is considered maximum capacity for Remington-Rand punched-card equipment. The monthly rental fee is \$1,100.

Time and cost savings: A significant saving of time was indicated in a statement by the machine-room supervisor. He reported that in comparing machine methods with manual methods, time is thought of in hours rather than days. There has been no study to establish definite dollar amounts or percentage figures. The large volume increase in operations distorts any comparison of time and cost savings that might be made in a superficial manner.

Accuracy factor: No records are kept to indicate whether there has been improvement in accuracy from the change to machines. It is assumed that increased accuracy has resulted from verification of punched information, internal checks in the system, and properly checked machines prior to beginning each function. It was indicated that errors must not be permitted because one error can be magnified many times over due to the speed of machine processing of accounting data.

Unique problems.---The supervisor indicated that the main problem encountered in changing from a manual method to a machine method is fear of loss of jobs on the part of the accounting and clerical personnel. In this firm it took three years to overcome this fear completely. It was the

opinion of the supervisor that this situation could have been alleviated much sooner had the employees been informed of the tentative change-over well in advance of the time that the actual change was made. From the standpoint of machine operations, a problem exists in this firm in terms of delay in receiving information from field units. The delay tends to upset the scheduling of the work in the machine-accounting unit.