

University of Mississippi

eGrove

Haskins and Sells Publications

Deloitte Collection

1956

Surveying the existing business organization in connection with effective machine methods of processing data (Non-electronic)

Gordon L. Murray

Follow this and additional works at: https://egrove.olemiss.edu/dl_hs



Part of the [Accounting Commons](#), and the [Taxation Commons](#)

Recommended Citation

Haskins & Sells Selected Papers, 1956, p. 170-185

This Article is brought to you for free and open access by the Deloitte Collection at eGrove. It has been accepted for inclusion in Haskins and Sells Publications by an authorized administrator of eGrove. For more information, please contact egrove@olemiss.edu.

Surveying the Existing Business Organization in Connection With Effective Machine Methods of Processing Data (Non-electronic)

BY GORDON L. MURRAY
PARTNER, CHICAGO OFFICE

*Presented before the National Association of Cost Accountants,
Fall Seminar Meeting, St. Louis Chapter — October 1956*

INTRODUCTION

I have been asked to discuss the subject of effective machine methods of processing data in terms of the methods study which provides the basis for any sound decision regarding mechanical data processing. In one sense my part in this seminar represents the less glamorous phase of the subject. Our colleagues who will cover the later subjects in this forum are free to talk about the many machines, devices, gadgets, and other marvelous paraphernalia comprising the tools of the modern-day accountant. The variety of kinds, sizes, types, and pedigrees of hardware has become so great that it has given rise to a new industry representing the various services now on the market. For a price, one now can subscribe to services which offer 10 to 15 pounds of pictures, descriptions, and specifications of available — or soon to be available — equipment as well as a steady stream of new releases a la Prentice-Hall and Commerce Clearing House.

A browse through such a catalog is a rather invigorating experience. Those responsible for accounting and other data-processing activities in an organization can visualize easy solutions to a wide range of problems. The risk of permitting company presidents and other members of top-management, not directly concerned with paper- and clerical-work, to see such a catalog is that they might well conclude their controllers and accountants have been missing the boat. Their reasoning might be that it is no longer necessary to put up with rising clerical costs, delays in reports, errors in statistics, and other such problems. Instead, they might reason, "Let us get our name on a purchase order and get a set of equipment delivered as soon as possible." Unfortunately, complex problems are not solved that easily.

The flood of new equipment which we have all seen, particularly since World War II, is truly wonderful. But because the flood is so great and there is such an increasing variety of equipment, confusion can easily result. The problem of selecting equipment is more diffi-

cult than heretofore, due, among other reasons, to the wide variety of alternatives which must be studied. The more choices available to a company, the more exacting become the problems of surveying and studying those phases in operations considered candidates for mechanization.

Therefore, I would like us to consider what is involved in determining whether mechanization is the answer to a particular problem and the factors to be considered in equipment selection. How are such problems approached? What are the principles and techniques?

PROBLEM SOLVING

First of all we should consider how problems are solved. How are problems approached successfully? What is the formula?

The successful solution to most every problem involves several basic steps:

1. First the problem must be defined and the objectives determined.
2. Then present practices and procedures must be determined.
3. Next, the various alternatives to a solution of the problem must be determined. A decision must be reached as to what alternative courses of action are available in the particular instance.
4. These alternatives must then be evaluated in terms of the objectives previously defined and within the limitations peculiar to the specific situation at hand.
5. This evaluation of alternatives should result in the selection of that alternative which most nearly meets the requirements of the objective.

Where do machine accounting and machine data-processing fit into this formula? Mechanization is one alternative to be considered in solving procedural problems, but it should be emphasized that machine methods are not the only alternative.

Why Consider Machines?

If we say that machine accounting equipment and techniques are alternatives which should be considered in solving accounting and data-processing problems, why should they be considered? What abilities do they possess and what are the advantages that we seek? Ordinarily, machine techniques are credited with achieving two basic objectives:

1. Improved management planning and management controls.
2. Improved methods of doing that which must be done to stay in business, such as efficient handling of billing routines, pay-rolls, etc.

More effective management planning and control may result from the ability of mechanical methods to produce more complete statistics, to provide information not obtainable by other means, and to reduce the processing cycle so that control information is available in time to take effective corrective action.

For a number of reasons machines are regarded as means for improving methods of performing what must be performed to stay in business, irrespective of considerations of management controls.

1. Reduction in cost is probably the factor most frequently considered. This involves the ability of machines to produce totals and balances as by-products of posting and recording operations — to write several documents at one time, to prepare two or more records simultaneously, to provide automatically and mechanically controlled features which eliminate operations and insure greater accuracy, to record a large number of routine transactions faster. The ability of machines to provide these advantages reduces the clerical time required and thereby reduces costs.
2. Another factor is the achievement of greater accuracy and improved quality. For example, a machine operation which produces several documents simultaneously improves quality and accuracy by eliminating transcription errors. Most accounting machines include features which automatically prove and balance entries made on the machine. Errors are flagged as they occur.
3. Machines also offer advantages in some situations through their ability to handle varying volumes of work and thereby ease problems of handling peak loads and bottle-necks.
4. It is often possible to achieve better internal controls through machine methods. For example, check-protecting and -signing machines, cash registers, etc., provide safeguards and improved internal controls.
5. Machine applications are also considered to reduce monotony, fatigue, and physical drudgery associated with processing a large volume of simple, repetitive, clerical work.
6. Machines can also improve the appearance of documents produced during accounting operations, such as invoices, customers' statements, and reports.

These are just a few of the advantages that are sought through machine procedures. Unfortunately machines are often considered and then installed for less logical and sound reasons.

1. There is a certain amount of "keeping up with the Jones" in machine processing. For example, there is some thinking that punched-card equipment is the thing every progressive company should have. The fact that a certain machine application works well for X-company does not mean it provides the answer for Y-company's problem. The latest and most expensive equipment is not necessarily the best for everyone and this often applies even to comparable companies in the same industry.
2. There is also a tendency to be fascinated with the action and apparent smoothness of operation of a machine. It is easy to observe the operation of a modern processing machine and conclude that it has wonderful possibilities which could not help but bring better results. This may or may not be true.
3. In some instances machine methods are installed, not on the basis of machine virtues alone, but to avoid having to solve other problems - primarily personnel, supervisory, and training problems. The present system may not be operating effectively, not because of faults inherent in the system, but due to improper assignment of personnel, inadequate training, poor quality of supervision, and lack of proper scheduling and control of workloads.
4. Machine systems are also installed as a result of over-selling by a supplier. Machine manufacturers have competent and trained people for the most part, but it is natural that they cannot be completely objective in recommending the acquisition of their equipment. If in their opinion their machine can be used in your operation, they cannot be blamed if they also believe it would produce better results. The approach is often one of saying, "Here is a piece of equipment which will produce the documents or reports you are now preparing, faster and more accurately." This approach ignores the necessity to consider the entire cycle of work in which that piece of equipment is but one part. The customer should make certain that he has adequately studied a properly defined cycle of work before final equipment selections are made.

Evolution in Mechanization

We have noted previously how wide a variety of equipment is now available and how the problem of methods study has become much more complex. The decision on whether or not to mechanize and how this is to be accomplished consequently requires a more sophisticated and thorough methods study than heretofore. We have also considered where mechanization fits into a solution to a problem and some of the advantages sought through mechanization. Therefore, it becomes appropriate that we next consider how a company decides that a methods study to weigh the advantages of mechanization is warranted.

The introduction and growth of machine accounting in companies usually follows a fairly well-defined pattern. Machine methods generally increase as the company expands and operations become more complex.

The first machines to be utilized are the typewriter and adding machine. Next comes a comptometer; then rotary calculators, when the volume of computational work increases as a result of cost work and more involved accounting systems.

Somewhere in the early stages there is a place for writing-boards on which to prepare payrolls, accounts receivable, and accounts payable. They are used where the so-called "write-it-once" principle has advantages but where the volume is insufficient to justify the use of a bookkeeping machine.

As statistical requirements increase, involving distributions and allocations in payroll, sales analysis, and other functions, peg-strip procedures using comptometers, and key-sort or uni-sort cards come into use.

Ditto and other duplicator systems are used for billing and purchase-order, receiving-report systems in order to use the "write-it-once" principle for achieving flexibility in number of copies.

The next major step is often the addition of a bookkeeping machine to obtain controlled-proof totals, post to more than one record simultaneously, handle larger volumes of work, and reduce clerical effort. By this stage the company has usually added such peripheral equipment as addressograph machines, check protectors, microfilm machines, etc.

A company then reaches the punched-card stage. Punched-card equipment is based on the principle that a unit of information punched into a card can then be machine-sorted, collated, computed, and tabulated in a variety of ways to produce the desired result. This prin-

ciple permits a good deal of flexibility and lends itself to a great variety of functions. Companies often move into the punched-card phase through use of an outside service bureau and later acquire their own installation when volumes reach the point where it becomes economically feasible.

As a punched-card installation grows and as a company becomes more decentralized, there is an input and transmission problem. As a result there have been a number of recent developments in what has been termed "integrated data processing." This involves the creation of paper tapes as a by-product of operations performed preliminary to punched-card processing. It is now possible to obtain adding machines, calculating machines, typewriters, bookkeeping machines and other equipment which automatically produce a paper tape of selected information. These tapes provide an ability automatically to transmit data over wires between geographical points and automatically to produce punched cards. Through tape-to-card and card-to-tape converters a great deal of flexibility is obtainable and much expensive key-punching and verifying is eliminated. In addition, IDP techniques permit completed forms to be reproduced at the destination office.

The ultimate development in punched-card equipment currently involves electronic machines operating from punched cards with an ability to perform a considerable amount of computational work, such as the IBM type 604 and 607 machines, C.P.C. unit and the IBM 650, without tapes.

The top plateau in machine processing involves electronic data processing about which we hear and read so much today. This evolution sounds rather orderly when it is recited in this manner. But many problems are involved in successfully surviving this evolution. The companies which come out of each stage most successfully are those which have most successfully adapted their operations to changed conditions. In terms of machine methods, success in this evolutionary process depends upon each company recognizing when it has outgrown one plateau and is ready for the next step, or when technology in mechanization has made the methods previously used obsolete.

Opportunities to improve operations through mechanization can be sought in two basic ways. Present procedures can be permitted to break down or reach the saturation point and a study of the problem and investigation of other methods then undertaken. This places procedural improvements on a crash basis — a poor atmosphere in which to arrive at sound decisions.

The alternative is to anticipate the problem by reviewing operations regularly looking not only for attractive opportunities to mechanize but also for other means of improvement as well. This more orderly approach has much to commend it.

Cycles of Work

In a methods study to determine the feasibility of mechanization or other procedural improvement it is essential that the scope include a complete cycle of work or of functions. There is a flow in paper- and clerical-work and each operation within that flow must be evaluated in terms of the procedural cycle of which it is a part. Better procedures result from combining, eliminating, simplifying, etc. Therefore a rather broad area for study should be taken rather than one small segment.

Let us take a relatively easy case which is familiar to all of us — billing. At first glance it would appear that the objectives of a billing operation are obvious — to provide a suitable document for presentation to our customer notifying him that certain services have been performed or goods delivered and that payment is due in accordance with certain terms.

If we proceed to study the mechanization of our billing operation in accordance with so limited an objective it is doubtful if any major achievement will result.

A more searching analysis will reveal that the problem is more complex. If we look back of the actual preparation of the billing we find certain procedural operations very closely related to the billing function.

1. Upon receipt of the order, action was required to call items out of stock, initiate production or procurement of items ordered, or initiate the flow of services to that customer.

2. Action was also required to review the order for credit, arrange shipment, and perform related shipping functions.

3. Provision had to be made to adjust inventory records for the transaction.

Subsequent to the preparation of the billing itself, there are also a number of closely related operations.

1. The billing is used as media for recording accounts receivable.
2. Sales analysis is prepared from billing copies.
3. Cash receipts are identified with a particular account and invoice.

4. Cost of sales computations often require use of billing copies.
5. Billings are also used in accounting for sales commissions.

In addition to procedures occurring both prior and subsequent to the bill preparation, the problem involves the actual preparation of the bill and provision for exceptions such as back orders and returned goods and allowances.

This closer analysis reveals that a review and evaluation of a billing operation immediately brings us into a whole series of operations. To mechanize such procedures successfully, consideration must be directed, not at billing as an isolated operation, but at the entire series of events of which billing is a part. In other words, the entire cycle of work — in this instance the "billing cycle" — beginning with receipt of an order and ending with the collection of cash, in-so-far as they are related to order-processing, should be included.

While this approach applies to other mechanical systems as well, it is particularly important in investigating punched-card tabulating applications. This is true despite the fact that the investigation usually is begun in a search for a solution to a single, apparently isolated problem. A realistic evaluation of tabulating equipment almost always forces consideration of a cycle of functions if the installation is to be economically justified. In order to obtain maximum utilization the equipment must be fully loaded. Therefore, a rather wide range of work must be sought to build up an economical load. Similarly the cost of getting original information into the card in the first instance can more easily be justified if the card can be used for more than one operation, without alteration. This is done by introducing the card into the cycle as early as possible. Therefore, this fact might just as well be recognized at the outset and the investigation started on the basis of a cycle of work rather than a single function.

A couple of examples will serve to illustrate this point.

Recently in conducting a study of a governmental agency we found that the preparation of payrolls was completely decentralized. Each department, division, and section kept time records, computed semi-monthly payrolls from gross-pay through net-pay. These payroll sheets were sent to a central tabulating department where the data were key-punched into cards and payroll summaries and distributions were prepared. The summaries were then sent to another department where checks were written. Checks were then signed manually. Certainly this did not comprise an effective operation. The system then in

effect resulted partly from defects in organization wherein no one had sufficient authority to study the whole payroll cycle. Therefore any improvements that had been made were confined to specific segments of what was really a broad cycle of functions susceptible to improvement in its entirety. This situation is now being changed so that the functions of the several departments are limited to maintaining time records. The central tabulating department computes gross pay, handles payroll deductions, prepares payroll checks — which are mechanically signed — distributes the payroll, and maintains earnings records.

I can recall another situation where a very fine mechanical accounts-payable system results in a remittance advice containing all of the information which appears on a check. This remittance advice then goes to the Treasurer's department where a group of girls at a battery of typewriters transcribes this data to checks. The checks are manually signed, hand-sorted when returned from the bank, and the accounts reconciled. There is no reason why the checks could not result from the machine processing except that the accounts-payable methods study was confined to the Controller's department.

In another case the problem apparently arose from a requirement for more elaborate sales analysis. The only practicable way to obtain the necessary sales statistics was through punched-card methods. However, the cost for this function alone would have been unacceptable. The scope of the study was made sufficiently broad so that the entire order-processing cycle was reviewed.

The system that resulted provides for invoices to be prepared mechanically from pre-punched header cards and item cards pulled from a tub file. The cards in the tub file represent quantities on hand and provide inventory control. Summary punched cards are used as the accounts-receivable record. Dollar- and unit-sales cards obtained as a by-product of billing are used to run sales statistics.

Therefore, I would like to emphasize the importance of properly defining the scope of a methods study so that piecemeal solutions are avoided. Departmental and other organizational lines should generally be disregarded. Attention should be directed to the entire related flow of paper wherever it occurs, both organizationally and geographically.

In performing this type of work for our clients we usually define the problem and agree upon the scope of the methods study - the cycle of work - by means of a preliminary survey of the client's facilities, procedures, reports, policies, etc. Such a survey usually contains all

the steps necessary in executing an engagement. However, it is limited in scope to that work which is required to form an opinion as to what the real problem is and what the objectives of a methods study should be. By following this practice we avoid undertaking assignments which would not permit the entire cycle of a function to be studied.

Study of Present Practices

The next phase of a methods study is concerned with determining what the present practices and procedures are. We must find out, through fact-finding, the answers to the who, what, when, where, why, and how questions. In addition, we must find out what the volume of work is in each step, and determine processing times, time requirements, and deadlines. We also need to assemble a complete set of forms, reports, and other documents involved. This material must be organized and recorded in a form that can be analyzed and evaluated in the next phase, which is concerned with considering the alternatives to present practices.

This step is not as easy as it may at first appear. Some companies utilize detailed procedure manuals. Other companies have very little if anything in the form of written instructions or formalized procedures. In any event it is urged that caution be used in relying on the written procedures. Deviations, changes, and exceptions which creep into so-called "standard" procedures are often startling. Too often the procedures manual represents what should be done and how it should be done, rather than what is actually going on in practice. There is no real substitute for taking a look at actual operations as currently performed. To make an effective methods study it is necessary to know what is actually going on and not to rely upon what is supposed to go on. Sometimes the solution is simply to enforce adherence to prescribed procedure rather than to change the system.

There are a variety of ways of conducting the fact-finding phases of a methods study. The choice of methods often depends upon the complexity of the problem, the available time, and the personal preferences of the persons conducting the work.

The most thorough and exacting approach is to conduct a desk-by-desk survey and interview each employee involved in the procedures. This can be shortcut by interviewing only one or two of a group of personnel performing the same operation. If this approach is used, the facts, once they have been organized and recorded, should be reviewed with supervisory personnel. This review should confirm the accuracy

of the facts, or the reverse, and determine to what extent they deviate from what the personnel have been instructed to do.

In some instances satisfactory results can be obtained by limiting the interviews to supervisors only.

A third method, which often results in a considerable saving of time, is to use questionnaires or outlines and have supervisors and/or employees submit write-ups of procedures. When this approach is used it is wise to check the information submitted to be certain that it is reliable and correct.

A combination of these methods is often used in any one study. For example, a desk-by-desk survey may be made in the home office and one or two selected branches with the other branches being covered by questionnaires or outlines to determine variations from the standard pattern.

Companies organize for such methods studies in various ways. Some companies have systems and procedures departments or staff assistants to conduct such work. In many instances outside professional assistance is utilized either to conduct the entire study or to serve as consultants to the company's personnel. In some instances a company will appoint a committee or task force to work on a particular problem on a full-time or part-time basis.

I should like to give a specific example of how one company is doing it. We are currently serving as consultants to a major public utility company which has become alarmed about procedures and methods problems in the paperwork areas of their business. This company has experienced a very substantial growth during the past twenty years, stemming in part from nation-wide expansion in power consumption by domestic and commercial customers. However, the company's growth has also been due to acquisition of a considerable number of other companies. The central problem, as one official characterizes it, is that the company has as many different systems as there were original companies. I can repeat one of the stories they tell about themselves. At the time they acquired one of these companies certain persons were moved into one section of their general offices. Until two or three years ago these people were not allowed to smoke at their desks although the employees on the other side of the aisle were permitted to smoke.

Because of the way this particular company grew, operations are decentralized in large degree. Various parts of the system are almost

autonomous as to methods in use. Some billing is done on Burroughs equipment, some on NCR machines, and some on punched cards. In many branches the billing is accomplished by manual methods. They recognize that there are no doubt substantial opportunities to improve procedures, that increased mechanization is going to be essential to provide good service and control clerical costs, and that there is a good possibility that medium- or even large-scale electronic data-processing machines can be effectively applied in their company. However, it was agreed that a piecemeal study would not accomplish the desired result and that before anything could be done they must find out just what the present procedures are. Therefore they face a rather substantial job of fact-finding before any decisions can be reached and before the objectives of the problem can even be specifically defined.

A study is now under way to catalog all present procedures. A team of four men has been assigned to work on this project on a full time basis. One is the supervisor of the tabulating department, another is head of the payroll department, another is from the internal audit staff, and the fourth member is the business manager from one of the larger and better-operated branches. We are serving as consultants to this group and are to develop programs, review the work performed, consult as to the techniques to be used, and assist in evaluating the information compiled.

In this instance it was decided that branch operations should be reviewed first and then the various home-office departments. We would then be working from the source of the transactions and the causes of the paperwork back to the home office where the information is processed, recorded, summarized, and reported.

None of these men have had previous experience in methods work. Therefore, it was decided that one branch should be selected as the pilot branch and serve to train these people as well as to permit them to gain some knowledge of what to expect when the many other branches were studied. A survey was made in the pilot branch on a desk-by-desk basis. The information obtained was recorded on a form which was drawn up so that the material would be as uniform as possible. Also they collected complete information as to the organization structure, the numbers of people by classification and by operations performed, complete sets of all reports and forms, and the volumes of work processed together with any seasonal characteristics.

Based upon the experience gained in this pilot branch a ques-

tionnaire has been developed to be used by the personnel in all other branches for recording their own procedures for submission to this study committee. One of the team members visits a branch and explains to the supervisory employees the nature and purpose of the study and how the information is to be recorded and assembled. A time schedule is agreed upon for submission of the data. After the material comes in it is reviewed and a follow-up visit is made to the branch to fill in missing information and to secure more complete explanations, where required.

The various cycles of work are being identified and flow-charts are being prepared for each branch. These flow-charts are based upon a standardized method so that comparisons of one branch to another can readily be made. Later, all of this material will be evaluated to determine better methods of processing data. One major area for consideration has to do with the extent to which data processing shall be centralized. We will not be concerned solely with what shall be done and how it shall be done but also where it shall be done. A realistic evaluation must take all of these matters into consideration.

In order to give you an indication of the type of coverage usually required in a procedures survey for purposes of mechanization I would like to quote from an actual set of instructions issued to certain department heads of one company for this purpose:

1. Prepare organization chart showing lines of authority, job titles or descriptions, and number of employees.
2. Prepare a procedure memorandum for each major work activity, describing each significant processing step.

Note: Procedural steps should be stated in brief, concise terms, or steps. Memorandum should include reference to each document record, file, or report submitted in connection with the following items on this questionnaire.

3. Submit specimen copies, completely filled-in, of all source documents received for processing:
 - a. Name of department or group originating the document, number of copies prepared, and distribution of each copy.
 - b. Average monthly volume.
 - c. Frequency of receipt (daily, weekly, monthly, etc.) and range of workload fluctuations.
 - d. Data added to the form by your department.
 - e. Processing done by your department.

f. Disposition of copies after processing is completed.

4. Submit specimen copies of all forms and records prepared by and retained in your department.

5. Describe reference files maintained, setting forth contents, average number of records in file, and the order in which records are filed.

6. Submit specimen copies, completely filled-in, of all documents and reports prepared and issued by your department. For each indicate:

a. Number of copies prepared and distribution of each.

b. Average monthly volume.

c. Frequency of preparation (daily, weekly, monthly, etc.) and range of workload fluctuations.

7. Describe mechanical office equipment used in the procedures and, for each unit, indicate the approximate number of hours used each month.

8. Estimate the approximate number of full-time employees engaged in each major work-area described above. Also estimate the approximate number of full-time employees engaged in minor activities not so described. The total number of employees accounted for should agree with the number shown on the organization chart.

9. Estimate the average number of monthly overtime hours for each major work activity.

10. Completed data should be submitted on or before (date).

Once the facts have been determined they must be organized in such form as will permit them to be evaluated. The choice of method to be used depends to some extent upon the complexity of the procedure. Some of the available methods are:

1. Write up procedure in narrative form.

2. Outline procedure as a listing of steps, in sequence.

3. Layout copies of actual forms and records on a large sheet in what could be called a "paste-up flow-chart" and add any notations required to explain the procedure.

4. Prepare a flow-chart, in which forms are represented by squares and procedural descriptions are shown.

My personal preference is the flow-chart accompanied by copies of the forms, records, and reports so they can be examined in conjunction with the chart. If a flow-chart is properly set up it is virtually impossible to prepare it if you do not have all of the facts. The type of flow-chart I prefer does not utilize symbols for the various opera-

tions performed but rather has departments or actions spread across the top. It also shows forms and reports in the form of squares labeled with the name, shows number of copies, and uses arrows to show flow.

Evaluation

Once the facts have been obtained and recorded in usable form the evaluation phase can be started. It is rather difficult to generalize on the way this phase should be handled as every problem is different. However, I can point out some of the factors which we have found to be important.

First, attention should be directed to determining the faults in present procedure using present methods and equipment. Obviously an alternative course is to continue with the present method. However, this should be accomplished on the basis of continuing these practices as they should be performed, which is not necessarily the way they are performed today.

There is another very important reason for this step. In too many instances, management is prone to discard one method in favor of another without first determining whether present methods are basically sound if properly set up and administered. Also before valid comparisons can be made between present methods and some alternative machine or method, the present procedure should be placed in its best form. For example, if you costed out your present billing procedure you might come up with a cost of \$1.00 per invoice processed. Some alternative method may produce an invoice of 85¢. It is entirely possible that opportunities exist for improving present methods that could reduce the per-invoice cost to 75¢. These improvements should be sought before any final decision to change the method is made. Sometimes the problem arises, not from the system at all, but from policy reasons, which can be changed.

One of the greatest errors that can be made in the evaluation phase is to fail to question the need and usefulness of what is already being generated in the form of statistics, data, and reports. We become so intent on the alternative ways of doing something that we fail to question why it is done in the first place. If the problem involves control reports there should be a definition of those elements in the operation which need to be controlled. The information required to effect control should then be specified. After this is done consideration should be given as to how these requirements can best be fulfilled.

It is not necessarily a simple matter of mechanizing the preparation of present reports. If this mistake is made the only result will be that the wrong answers are being provided many times faster, or something will have been mechanized that did not need it in the first place.

Often mechanical equipment looks attractive in order to achieve speed or the ability to handle an increasing volume of work. The first questions to ask are not how to achieve the speed, but rather what the increased speed is worth — what would it be possible to do differently if the data were available sooner — or what is causing this increased workload. Speed may be unnecessary and an increased volume of work may be an "effect" rather than a "cause."

CONCLUSION

In conclusion I would like to emphasize that machine methods offer an attractive solution to data-processing problems if they are properly selected and applied. Mechanization comprises one set of answers but not the only answer. The important thing is continuously to evaluate your own position — decide what plateau you are on and when it is time to move to the next level of mechanization. Then, define your objectives carefully, consider complete cycles of work, be sure of your facts, and then apply some real imagination to the problem.