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AUTOMATION AND MECHANIZATION IN LOCAL GOVERNMENT ADMINISTRATION

Papers presented at the
World Conference of Local Governments

WASHINGTON, D.C.
JUNE 15—20, 1961

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INTERNATIONAL UNION OF LOCAL AUTHORITIES

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PREFACE

Mechanization and Automation, as regards local government administration, was introduced as a IULA congress topic for the first time at the World Conference of Local Governments which took place in Washington, D.C., June 15-20, 1961. With the general conference theme being *Recent Developments in Local Government Structure and Organization*, it was only natural that the advantages and possibilities of the use of mechanical and electronic systems and equipment by local governments should be considered a fitting subject for a seminar. For the constantly increasing tasks which local governments are called upon to perform, the public demand for speedier, more accurate and less expensive administration and the example of industry, which makes extensive use of electronic equipment, has brought the question of whether or not to mechanize and/or automate operations, and to what extent, to the attention of local government officials throughout the world. This is, indeed, a recent development in local government administration that can lead to far-reaching changes — not only in structure and organization, but in scope and depth of services that can and must be provided.

The present volume contains the speeches and discussions which were held during the course of three seminar meetings on this topic. Unlike the other seminars, that on Automation and Mechanization featured, in addition to two keynote speeches, two case studies on present-day uses of mechanical and automated equipment by local government administrations. After the presentation of each case study comments and comparisons with his own experiences were made by a discussant prior to the opening of the session to a general discussion period. The reporter for the seminar sessions was Professor Salvatore Rebbecchini, Former Mayor of Rome and Member of the IULA Executive Committee.

In addition to the present volume, similar books are available which contain the proceedings of the plenary sessions on the main conference theme and those of the other seminar topics — Public Relations, Problems of Metropolitan Areas and Personnel Administration. Because of their close relationship, the speeches and discussions concerning Problems of Metropolitan Areas have been included with those on the main theme of Recent Developments in Local Government Structure and Organization. Also published in book form are the proceedings of the two congress sessions devoted to Town Affiliation. In addition, the pre-conference reports, all of which were prepared this year by American experts, have been printed under the title of "Local Government in the United States of America" and are publication nr. 57 in the IULA series.

The present book should be of value to many people concerned with

local government administration — elected and appointed officials, local government employees and interested citizens — for it gives a clear-cut picture of just what mechanization and automation are; why they should be used and for what purposes; how they can be applied and under what circumstances; when they should be inaugurated; what are some of the problems surrounding their installation and how these can best be handled; and what the results of their use can be. It opens, in fact, a new vista for local government administration, both in the near and the distant future.

N. ARKEMA

Secretary General of the
International Union of Local Authorities

ADMINISTRATIVE MECHANIZATION AND AUTOMATION IN LOCAL GOVERNMENT

by

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The continuing struggle of public officials to maintain sound and healthy communities in face of the greatest population multiplication in history is the most singular phenomenon affecting local government in the 20th Century. This ever-present challenge you will recognize in your own city as we do in ours.

There are many consequences of this unprecedented and continuing population advance. We concern ourselves today with the foreseeable end-product of a simple, logical progression: More people — increasing urban concentration — louder demands for expanded public services and better methods to satisfy the legitimate needs of our communities. Greater efficiency in local public administration is, therefore, the goal we all must attain. Technological achievements, mostly the result of the second Great War, are many. Atomic energy, radar, jet propulsion and missile mastery are but a few. Automation and mechanization are and will continue to be important influences in the field of local government, as they are in private industry.

At the outset, we should have a mutual understanding of the two big words of this Seminar: Mechanization is the substitution of mechanical for manual operations. Automation is the substitution, for manual or mechanized operations, of machines having an "internal" or "built-in" program of instructions capable of providing decision-making data produced at electronic speed. Most municipalities utilize some form of mechanization. This varies from a simple adding machine to the latest „electronic brain." We stress in this discussion the usefulness to local government of more sophisticated systems where accuracy and great speed are needed to improve operations and administrative decision-making.

Record-keeping and computation have posed many problems down through the ages. The last twenty years, however, have flavored this ancient "occupation" with a tinge of glamour, excitement and the promise

of widened horizons. A sense of numbers goes back to the beginning of the human race when primitive men distinguished between one, two or many. As society became more complex, increasing emphasis was placed on recording and calculating equipment. A significant advance in the development of data processing for government came about because of a legal requirement that we have a decennial census. It took seven and one-half years to complete the compilation of the census of 1880 to count a population of some 50 million people. The by-products of a census which are most useful today were not attempted at that time and much additional data was treated in so simple a manner as to be of little use. The punched card system, which was developed by Dr. Herman Hollerith in 1886, was first used in the federal government and only later was extensive use made of it in industry.

Example of Industry — Should Local Government Emulate?

Since emphasis at this point should be on goals or broad objectives rather than on methods or techniques, we ask ourselves the first of two fundamental questions: Should local government follow industry in utilizing mechanical and electronic systems and equipment? In my judgment, the answer is YES. The evidence points strongly towards the advisability of local government following industry to the farthest extent possible.

The real question facing most local government administrators today is not should we, but rather: Why and when and how can we better utilize mechanization and automation? Let us look into a few of the why's.

Automation - Why

Results in Industry

First, what has industry accomplished in this field in recent years? For large companies, integrated data processing which makes extensive use of electronic equipment has long been an essential tool to efficient operations. As customers, we are quick to recognize the neat smartness of insurance premium notices and receipts and of monthly bank statements, now that magnetic ink characters are used. Moreover gas, light, telephone and water bills reach us from high speed computers. Just yesterday I noticed that the ticket on the box containing my freshly laundered shirts was a tab card. The wide horizon of industrial and commercial users ranges from retail trade to rocketry.

Many small and medium-sized firms have successfully completed their electronic data processing "shake down cruises". Such businesses include auto parts dealers, machinery builders, food wholesalers, manufacturing

plants and many others. In the United States, we are told, there are 15,000 firms employing 50 to 100 clerks each. A high percentage of these will experience the usefulness of high speed data processing, especially with the growing number of conveniently located service bureaus.

The Rapid Expansion of Local Government

The swelling increase and concentration of population has enlarged local government activities. Traditional services of local government have grown at a rate unprecedented in our history. And many new services and functions have been added.

A few basic figures will tell the story in the United States. During the 1950's total expenditures of local governments went up by 113 %. Expenditures have more than doubled for such functions as police and fire protection, education, recreation and health services. Debt of local governments has grown by 151 % during the last ten years. Many cities are now faced with the need for tremendous outlays for urban renewal and modern transportation systems. Suburban communities, too, are faced with greater demands for basic community facilities. Citizens continuously raise their standards for adequate public administration and this is clearly made known at the local level.

The speed with which decisions must be made by good managers, both in public and private business, far surpasses the leisurely pace of just twenty years. Some of us can remember the time when making an administrative decision was easy. The manager could walk out into a shop or a supply area of a waterworks and notice that he was running short on a certain type of material. The answer was simple; he went back and ordered some more. The head of an inspection department glanced over his reports and noticed that certain people weren't turning out a full day's quota. He talked to these people and the situation was usually corrected.

Office work was equally simple. Employees were paid sometimes in cash, and in the larger organizations, by handwritten checks. If you were in a private chemical industry, and wanted to check a formula, you sat down with a piece of paper and a slide rule and figured it out.

Progress came, and with it came armies of clerks to digest and analyze mountains of paper. At this point, the manager realized that the facts he needed to make clear, correct decisions just weren't available at his finger tips any more. During the last few years, however, many administrators have handled the assimilation of engulfing data through the use of electronic processing machines.

Mechanization and automation can provide the means by which we, as local public officials, can control what has been termed the "information explosion". These advanced tools will take over much of the time-consuming and routine work involved in studies and research and, moreover, they will produce the right information when it is needed. We now have equipment that can sort, store, classify and present data. Manufacturers of automated equipment tell us that in addition, equipment will be available to read, file and even summarize work on a printed page and recover it for use when needed.

Problems are solved by making the right decision and the right decision is based on all relevant data and information. We are far along the path of collecting, classifying, analyzing and interpreting great volumes of data to effectively bring them to bear on the problems we face in local government administration. For some time, many functions of local government have been strengthened through mechanization and automation. Here are a few examples:

Health and Welfare — Aid to dependent children and general assistance require vast outlays of funds for their adequate administration. Data on births, deaths, communicable diseases, immunization, accidents, health inspections and other information provide the foundation for an efficient municipal health program. Both administrative and financial control in these areas have been improved through high-speed reporting.

Highways — In most communities, traffic strangulation is a pressing problem. Traffic engineering is materially advanced through mechanization and automation because relevant data is now available for making remedial decisions.

Finance — Budget preparation, appropriation accounting and control, revenue forecasting, payroll, accounts payable, tax billing, assessments and inventory accounting have become fitting subjects of high-speed mechanization. Results to date are impressive.

Election Procedures — The maintenance of voter registration lists is effectively speeded up, especially in the larger communities. The ebb and flow of registration changes can be handled accurately and expeditiously.

Public Safety — Law enforcement departments have been using mechanized procedures for a long time. Crime statistics, criminal identification, various court records, traffic violations and juvenile delinquency can be pinpointed to locations, times and frequencies. The employment of manpower is thus facilitated.

Utilities — A municipally-owned utility bills and services its customers in a manner similar to a privately-operated utility. Cycle billing, meter reading and operating statistics can be provided in short order accurately and speedily through mechanization and automation.

Planning — Effective city and regional planning involves the collection, analysis and synthesis of much data relating to trends in population, land use, community facilities, transportation and utilities. Accurate and prompt processing of this data has done much to improve the planning and development of our urban areas. Much of this data is interchangeable with other municipal departments.

Cost Consideration

Cost implications of electronic data processing are most significant. Many governmental proposals flounder because no clear-cut cost reductions can be forecast for the near future. We must remember there are many tangible and intangible offsets to actual costs. These include the ability and capacity to do many present tasks with greater scope, accuracy and speed. Local government now has the opportunity to provide many desirable new and expanded programs for the benefit of its citizens.

On the other hand, many decisions to move into the EDP field can be justified on cost savings alone. But cost alone should not be the sole determining factor.

A Look Ahead

Another "why" for local government to move ahead with automation lies in the future. Performance measurement, which has for its objective cost control through reduced dollars, higher quality standards, or both, should be readily adaptable. One can comfortably visualize feeding standard performance data into the computer's memory cell and then, after developing the actual dollars or units, have the computer provide automatic and near instantaneous comparisons. Unusual variances, suggesting management by exception, could be analyzed and supported by computer-prepared schedules.

In the same fashion that mechanization twenty years ago permitted large manufacturing plants to operate effective and flexible departmental budgets, so automation in the near future can do an even better cost controlling job for local governments. Moreover, general accounting, which is undoubtedly more complex, will, with advancing technology, be a suitable subject for automation.

Automation – When

Timing of human events is of the essence of success. When to inaugurate a program of automatic data processing is just as important as why it should be done.

Hard and fast rules on when an enterprise should consider the use of electronic data processing are non-existent. Operations of growing volume and repetitive nature which require continued use of present mechanization facilities are ripe for transition to electronic data processing. Before the program is launched, however, many carefully considered steps should be taken if expected beneficial results are to be obtained.

Legal

First, I think it most important to take a look at the legal ramifications. Archaic laws, regulations or constitutional requirements may impose rigid restrictions that hamper the flow of information to and from electronic systems. Obviously, the answer here is to change these laws and regulations. This is not as difficult as it once was and many communities in the United States have been able to streamline their charters and local operating codes with increasing effectiveness.

Feasibility Study

A detailed study and analysis of present methods and systems which lead to adequate programming is another essential step before actual operations begin. To carefully set down and study each step of the way is to prepare a feasibility study. This study is basically one of evaluation and not an exercise in design. Its scope and objectives should be thoroughly understood, controlled and directed by top management. We can then say that from the very beginning and leading up to the point of decision to install electronic data processing equipment, considerable and careful groundwork has to be completed. For local government, this is just as important as it is in private industry.

Independent Expert Advice

The well-qualified and experienced outside consultant can provide very valuable assistance to an organization preparing for and installing EDP. His value lies chiefly in his wise counsel, springing from an objective viewpoint. His expert advice flows from an independent position in very specialized areas that cannot be secured from conventional sources.

The role of the consultant should be as the title implies — that of a counsellor. He should review and advise, but not "do" for you. The

consultant can render invaluable assistance. but it is most important that you develop and make good use of the skills and talents you have within your organization.

Legislative Approval

In government the responsible administrative authority has to convince the legislative body, be it the city council, board of commissioners or other organization, to provide the necessary funds to finance the proposed program.

It is well to remember that elected public officials are most reluctant to authorize large sums of money to study a program about which most of them are entirely unfamiliar and about which they are not thoroughly convinced that success can be found at the end of a long and arduous road. It is important that members of the legislative body be convinced, through careful preparation of the administrative program, that EDP will prove beneficial. It must be pointed out that the continually improving equipment, expensive as it is to acquire or rent, can do a reliable, economical and speedy job in carrying out many governmental services. Legislators have to be convinced that over the long period of time good results can be achieved. This can be done only through the presentation of a complete, reliable and understandable long-range program of data processing.

Automation - How

The approach to mechanization and automation of the data processing function of a municipality is variable. The least satisfactory, yet the most common, approach is to take one particular process and change the means by which is is accomplished. In other words, to duplicate the present operation using more advanced equipment. The rationale is that results may be accomplished at a lower operating cost faster and more accurately. These certainly are valid reasons for changing the procedure. In many cases the change is made only to provide more advanced information with an assumed look of progress.

Another more logical approach is to integrate the data processing function. This implies joining together in a unified system the entire data processing operation of an enterprise and so organizing the information that it is processed at the opportune time and place, at a minimum of cost and error. To be sure, an integrated system must recognize the relationship among various departments and agencies and the information required for each to carry out its respective responsibilities.

Experience in local government in the United States shows that the same information is often required by several departments to properly perform their assigned functions.

An example of this is the recording, assessing and billing of real property taxation. All changes in ownership and lot descriptions must be filed with a central department with certain legal responsibilities. Much of this same information is required to update the tax assessment rolls maintained by the property assessors. The same information is also needed by the agency responsible for tax billing and collection.

Computers have the capacity and capability to become a central point of control for most operations of a local government. It is important to emphasize that the administration must think of all its responsible functions when laying out an electronic data processing system to realize full potential. Effectiveness is diluted when a few selected functions are integrated into the new system and departmental barriers to communication remain intact. Wherever possible, governmental managers should combine all data processing operations into a single functional organization, crossing existing lines of authority with regard only to total efficiency.

Many critics maintain that such a policy will foster undue centralization of authority and control. I think the more logical view is that centralized data processing will strengthen decentralized or departmental authority because there will be available better facts for local decision-making. Since the computer will centrally accumulate necessary information from every department and agency of the government, this will also strengthen the decision-making potentials of top management. With the computer as a center serving all agencies of the government, it will be necessary to determine the logical agency to be responsible for this function and proper lines and extent of authority.

Education — The full system approach to the design and introduction of electronic data processing carries with it many important considerations for any organization. Effects are both internal — within the organization — and likewise external — touching significantly on relations with citizens who, in fact, are our employers, clients and customers. Management has a job of education to accomplish — education for innovation. Four basic areas must be covered:

1. *Human Relations* — In most organizations, there is a great resistance to change because there is usually contentment with "things as they are" or limited vision to see "things as they should be". Resistance results from fear of change and its effect on each individual's well-being

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and security. This can be overcome somewhat by recognizing human motivations and directing them to worthwhile channels.

2. *Management Technology* — A data processing system opens up new avenues of management technology. The new system should not merely duplicate present operations. However, to take advantage of this system, management people must have some understanding of the technical capabilities so they can further define their informational requirements and thus better carry out their functional responsibilities.

3. *Broad Understanding* — Those who will design and implement the systems change must be educated in the different aspects of the organization's operations and in the technical aspects of systems design and computer programming. Without intimate knowledge of both the systems requirements and computer technology, the analyst will be unable to design an effective, efficient and economic system.

4. *The Public* — This category includes groups outside the organization, the citizens and taxpayers. These are really the ones to whom you are responsible — the main reason why you "are in business". If their invoices, tax notices or purchase orders are to be sent out in a different format or on a different calendar basis, they must be advised in a timely manner. Likewise, their cooperation must be sought if these documents will be used as further input into the system. Local government must also be sensitive to its relationship with the press, unions and professional or citizens group.

Education is a slow process and a continuing process. Because it takes time to absorb new concepts the educational program should be given attention equal to the technical aspects, not subordinated to more glamorous areas where results can be seen immediately.

Staffing — Once the atmosphere is set for acceptance of major systems changes, we in government still have a problem in implementing our program. Management problems, particularly in the personnel area, are most difficult. A competent, adequately trained, highly skilled staff is an absolute must.

We have found it difficult to recruit competent personnel in this highly competitive field. Quality is of the utmost importance and cannot be replaced by quantity. Normal recruiting techniques do not seem to work as in other areas. Selection of employees from within based on specially designed testing methods, coupled with intensive schooling and training, appear to be the sound approach to an adequate staff. Undoubtedly, the personnel problem will continue to be a critical one during these early years of electronic data processing.

Human and Psychological Consequences — May I say a word about the most important aspect of automation and mechanization — the human aspect. It is in this area where we may easily fail to realize maximum benefits. I cannot propose ready solutions. The human mind and personality have always created situations that can never be solved by rigid, dogmatic policies. We will have to adapt to situations as we face them. In doing so, we must avoid the backward tug of old and obsolete dogmas of the past.

Basically, the adoption of advanced mechanization and automation means adapting ourselves to new situations, adjusting to new methods and revising past habits. To achieve the real advantages from these tools, it may be necessary to change many existing organizational relationships that have existed for years. All of us have a natural reluctance to change — especially if we do not understand the reasons or the real implications involved. The routine is preferred to the unfamiliar. Changes are never readily accepted even though they may in the long run make a person's job easier and his work more efficient.

One way in which all of us can aid in making changes is to plan carefully. Anticipate and allow for human conflict. Employees at all levels affected by mechanization and automation should be in on the planning. Ask for and get their suggestions, ideas and opinions. Give full credit for worthwhile suggestions. But, above all, never fail to give due respect to individual problems, feelings and attitudes. Employees should be advised and fully informed of all major changes — preferably before such changes are made. Do not require people to work with something they do not really understand.

Previously, we asked ourselves the question: Should local government follow industry in utilizing mechanical and electronic systems and equipment? We now inquire: What has been achieved in mechanization and automation as far as local governments are concerned?

Mechanization in the form of punched card machines has been available for about fifty years and is used extensively throughout the world. Local governments have been slower to adopt mechanized equipment than other levels of government or business. However, there are many local governments which have shown excellent progress.

Municipal Finance Officers Association

Last year the Municipal Finance Officers Association of the United States and Canada, a professional organization having over 3,000 members, conducted a survey on the use of mechanized equipment in govern-

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ment accounting. This survey was made in response to extensive interest of finance officers in the present and potential uses of electronic computers, tabulating devices and other types of mechanized equipment. A total of 605 questionnaires were mailed to local and state government units in the United States and Canada. Replies were received from 350. In general, the rate of response was higher for the larger units, thus reflecting the greater mechanization in the larger units and the greater volume of data which they encounter.

About 92 % of all units reporting had mechanized accounting systems. For the most part, this covered bookkeeping equipment rather than tabulating or electronic equipment. Most large jurisdictions are investigating the possibilities of using electronic data processing equipment. The function most frequently performed by tabulating equipment is payroll processing, followed by tax billing and appropriation accounting.

Only 29 of the units have electronic data processing staffs, although 42 have completed feasibility studies and eight more are in process. Seventy-seven of the units expect to install electronic data processing equipment within the next years.

It seems safe to conclude from the survey that the larger the governmental unit, the more likely it is to have some form of mechanized or automated equipment. States, counties and cities having more than 100.000 population most frequently use a full time staff of systems analysts.

Considerable information is available detailing the extent and advantages of mechanization and automation in local governments. Let me summarize the activities and results in a few municipalities:

New York City — An electronic data processing system has been installed and is used primarily for the payroll processing for some 150,000 City and School Board employees. Because the State of New York requires municipalities to withhold state income tax, it is estimated that the City saves approximately $ 300,000 annually because this function can be done electronically rather than on the former tabulating equipment. The withholding function was included in the computer program at no significant additional cost. Substantial additional savings are anticipated when the City's fund accounting is placed on the electronic system.

Los Angeles — the City's planning staff is currently programming appropriation accounting, a payroll for 26,000 employees and the licensing of approximately 500,000 buildings and 500,000 businesses. These three applications are scheduled for conversion to an electronic system with operations to start next month.

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The County of Los Angeles is currently preparing its assessment roles for 1,700,000 properties and programming tax invoice preparation and accounts receivable to be included in the electronic system. This conversion will be augmented by adding the County's public assistance program involving 170,000 persons.

Detroit — This city was one of the first municipalities to install an electronic computer although it has not yet converted to an electronic data processing system. The computer enabled the city to accomplish certain programs which would have been otherwise impossible. These include social security processing as well as the calculation of assessments.

New Orleans — Last year this city converted payroll and budgetary operations from mechanical to an electronic system. Conversion of sales tax and business license procedures was scheduled for the middle of 1960, and real estate tax accounting for January 1961. The Director of Finance has indicated that little additional equipment will be required to take care of the city's needs far into the future.

The use of mechanized equipment in government accounting and the growing importance of data processing for administrative and other purposes by government agencies of all types has prompted the Municipal Finance Officers Association to establish a new Committee on Data Processing.

Progress in the Sixties

We in local government can look forward to our increasing complex problems in the Sixties with optimism. We have many strong currents flowing our way, not the least of which is progress through constantly improving technology of management's most promising administrative tools — mechanization and automation. But let us flavor our optimism with a generous measure of cautious realism. All along we have been considering mechanization and automation, past and future, as techniques only.

Value judgments must always be of human origin and not machine fashioned. Very early in life we recognize the unbridgeable decision-making gulf between man and the machine. The machine can make a "decision" only after the major and minor factors, inherent in any judgment, are fed by someone into its digestive tract. Automation is a wonderful tool — but only a tool. The millennium of push-button government can never be realized.

I am quite confident that the next decade will see the duties and responsibilities of local governments in the United States expand very

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considerably. As of today, except for national defense, they provide the primary services which all of us must have day in and day out. Local government educates our children, protects our health, provides for our safety and civic order, influences the residential, commercial and industrial development and rebirth of our urban areas and will determine the course of our future metropolitan civilization.

This is undoubtedly the role of local government and we had better be ready for it. To do a good job requires enlightened, imaginative and matured management, thought and action. Administrative mechanization and automation are high on the list of indispensable tools. They can help us effectively allocate limited resources because they are positive instruments of municipal management and they can be of great assistance in pointing the way to financial stability. Municipal officials must always be looking ahead. We must expect various eventualities, but only if we plan with care, with vision and with realism can we expect to provide the real leadership necessary for effective municipal administration.

Chairman Dr. Lowell Hattery introduces the main seminar speakers, Mr. Richard J. McConnell and Dr. Werner Jähnig (far left).

MECHANIZATION AND AUTOMATION
IN PUBLIC ADMINISTRATION

by

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I. DEFINITION AND SIGNIFICANCE OF ADMINISTRATIVE MECHANIZATION AND AUTOMATION

1. Definition

1.1 *Part of the organization*

Mechanization and automation are part of the general problem of organization. Before they are used in a specific case, however, the proper organizational set-up for the particular circumstances should be worked out. As concerns scope and economy of operation, mechanization and automation may help provide a good organizational pattern, although before this can be realized the existing sequence of operations should be very thoroughly examined.

1.2 *Means of organization*

In the broad field of mechanization and automation in public administration, it has become customary to call the use of organizational means (or means of operation), up to the introduction of punched card machines "mechanization", and from the introduction of electronic data processing machines onwards, "automation" or "automatization". [1]

This definition may not be quite satisfactory but it is sufficient for the present stage of development. As it has gained currency in international exchange of experiences and is also used by the International Union of Local Authorities, it should be kept for the time being.

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[1] Some people use the word "automatization" instead of automation, thus complicating the definition, as they are of the opinion that the term "automation" can only be applied if "the production of source data and their feeding into the machine are also automized" (among others, see Hartmann "Betriebswirtschaftliche Grundlagen der Datenverarbeitung", 1961, page 20.

1.3 Single-purpose and general-purpose machines

Where mechanization is concerned, a difference must be made between single-purpose machines (and equipment) and general-purpose machines as to the performance of work.

Single-purpose machines will only perform one job, whereas general-purpose machines, the first of which was the punched card machine, are able to perform several jobs (such as classifying, calculating, printing, etc.). The remaining mechanical machines (typewriters, duplicators, addressographs, bookkeeping, invoicing and calculating machines) must therefore be considered single-purpose machines. Where automation is concerned, there are only general-purpose machines (electronic data processing machines).

The distinction between single-purpose and general-purpose machines does not contain any judgment as to their value. There are single-purpose machines which are and will always be indispensable for administration [2]) and single-purpose machine can also be used in combination with general-purpose machines. We are, however, of the opinion that technical development and economic considerations are leading to the increasing use of the general-purpose machines and the decreasing use of the single-purpose machines.

1.4 Universality of procedures

Universal procedures such as the punched card system and automation affect an entire administration. Since a general-purpose installation is not only used for work of one single office but also for all other offices concerned, the application of a procedure has a universal effect. This implies that all offices concerned must adapt their methods of operation to the universal procedure. It may, for instance, become necessary to revise the sequence of operations, to alter and adapt forms and to consider advantages which the specialized procedures used until then did not yield. The general-purpose installation is sometimes compared with the central nervous system of the human body.

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[2]) The Inter-Municipal Bureau for Administrative Simplification (KGSt), a central institution which arose from the Deutscher Städtetag and since 1956 has been legally independent, is concerned with all questions of organization and rationalization in local government. In the field of mechanization and automation, it has presented general reports, circulars and information on special subjects, such as writing service, reproduction, microfilm, forms, means of communication, means of transportation, addressographs, calculating, invoicing and bookkeeping machines, as well as working figures for general-purpose machines (punched card machines, electronic data processing systems).

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2. Significance of the task

The fact that the International Union of Local Authorities has chosen mechanization and automation as one of the main themes of this year's world congress seems to confirm our theories that:

1. The scope of mechanization and automation can no longer be minimized; it should not be dismissed as a part of mere "office reorganization", which according to some people does not concern top management.

2. Decisions on mechanization and automation are the concern of leading executives on the level of top management.

This results from the over-all importance of their use and such administrative implications as:

1. High purchase or rental cost, particularly for such high-quality single-purpose machines and electronic data processing equipment.

2. Serious decisions in personnel matters, because it is most important to choose active employees with some experience in organizational problems and some understanding of technical matters and to give them full authority to introduce and carry out the mechanized and automized procedures to an economic success.

3. Important decisions in organizational matters, because universal procedures such as the punched card system and automation have serious effects on the organization of public administration as a whole and force all offices concerned to cooperate intelligently.

4. Exploitation of information techniques in automation in order to obtain faster, safer and more objective results. By changing from a subjective to a methodical way of thinking, it is possible to dispense with intuition.

The importance of this situation is only realized little by little. The decisive fact is that it is realized at all by top management, for it is absolutely necessary that leading executives should take an active part in order to obtain all the advantages of mechanization and automation for public administration and to exclude any disadvantages.

3. The example of industry

The International Union of Local Authorities has asked whether local government should follow the example of private enterprise in using

mechanical and electronic systems and equipment, i.e. punched card machines and electronic data processing systems. From the broad field of mechanization and automation, only the use of the above-mentioned means for administrative purposes shall be discussed here so that the subject is limited to its proper perspective.

The reference to the example given by industry may come as a surprise, for public administration is not an industrial enterprise; it provides a service without regard to whether or not it yields a profit. Nevertheless, public and industrial [3]) administration have many things in common. Economic principles must also be applied in public administration, because otherwise it is impossible to cope with the ever-increasing work that confronts us. In the field of organization there are many cases where public administration can very well bear comparison with industry. One of these is clerical work, concerning which industry and public administration must overcome the problems which arise and find an organizational structure which does not endanger the economic management of the enterprise.

The reasons for the model situation in industry lie in the fact that industrial administration has for some time been undergoing a basic change, whereby the science of management has been introduced. Among other things, this has helped to increase the importance of administrative and managerial tasks in industry. This is a process which is becoming more and more important and is changing both the nature of the methods applied and the kind of employees hired.

"Common sense" is by no means eliminated, but is is being replaced by analytical thinking. For this purpose, scientifically trained personnel, such as organizers, business administrators, mathematicians, engineers, and industrial and national economists are used. For their job they need the most modern machines in order to arrive at solutions which could not be provided by those previously used. Thus, scientific management has gone together with the introduction of the punched card system and of automation in industrial administration. There is no doubt that in industry this development started earlier than in public administration, although is must be pointed out that the German Railways and Postal Authorities applied up-to-date mechanization and automation even before industry

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[3]) Cf. the speech of Dr. Badenhoop, president of the Inter-Municipal Bureau for Administrative Simplification (KGSt), before the members of the Committee for Economic Administration at Frankfurt on Main, February 24, 1961. His subject was "Municipal Organization and Rationalization and its Practical Application in the Industrial Economy". A reprint can be obtained from the office of the KGSt in Cologne-Marienburg. Further cf. the speech of Dr. Badenhoop on "The Application of Modern Methods in Local Government" before the European Management Conference in Torquay, Great Britain, October 1954.

began looking. Moreover some German municipalities, such as Frankfurt on Main and Cologne, introduced punched card systems in their administration thirty years ago, thus doing pioneer work for the whole of public administration.

Industry has no rigid standard regulations and therefore enjoys more freedom of action than does public administration. Moreover, in industry some clearly defined, frequently recurrent routine operations have to be carried out, which has led inevitably to the introduction of punched card machines and electronic data processing systems. In local government, on the other hand, far more numerous, not regularly recurrent operations have to be carried out. Although this is only partly routine work, it can nevertheless for the most part be standardized and programmed, conditions which are necessary for the application of the punched card system and automation. With automation each of these operations causes the same expenditure of work for the preparation of data input.

Mechanization and automation in industrial administration have become such a success that today nobody can imagine how things would be without them. Nobody will deny that the adoption of these organizational methods was a rational thing [4]. In individual cases, it may of course be doubled whether the proper technical equipment was chosen (comparison of systems), whether, organizationally, instead of a large installation (concentration) several smaller installations (decentralization) would have more economically suited administrative requirements, or whether mechanization by punched card machines or automation would have been more economical. Similar conclusions can be drawn for such other aspects of the economy as commerce, insurance companies, transport undertakings and banks [5].

II. CONSIDERATIONS AND QUESTIONS

The answers to the following questions raised by the International Union of Local Authorities are based on many years of close cooperation with German local governments and on international exchanges of experiences.

[4] "In many countries, both the structural improvement of the bureaucratic type of organization and the increasing application of mechanical methods instead of manpower are often called rationalization" (Cf. Morstein Marx, "Einführung in die Bürokratie", 1959, page 37 or "The Administrative State", pages 24/25).

[5] Many local savings banks are also, to an ever increasing degree, successfully using the punched card system and automation for procedures formerly performed by various types of bookkeeping machines.

1. "Can the work be done more cheaply?"

This question should be examined from the point of view of both material and personnel costs.

1.1   Material cost

1.11   Correct comparison of costs

Generally, punched card machines and electronic data processing systems are expensive. Compared with previous machines or even manual methods of operation, increased costs are incurred by buying or renting this new equipment. Without this high cost of machinery the administrative work would therefore be performed more cheaply. Such a rough comparison of costs is false, however, because it does not consider the possibilities of use. Punched card machines and electronic data processing systems are, as was mentioned above, general-purpose installations whereas office machines such as typewriters, addressographs, calculating, bookkeeping, invoicing, and auxiliary machines must be regarded as specialized single-purpose machines. Thus the following theories can be put forward:

1. With the necessary organizational adjustments, punched card machines and electronic data processing installations can perform all types of administratives work that can be systematized and programmed, whereas specialized single-purpose machines can be used only for specific work.

2. The introduction of general-purpose machines, provided they are utilized correctly, reduces the cost of administrative work. The use of single-purpose machines, of which inevitably a greater number would be required, leads to an increase of cost.

3. The use of a general-purpose installation can even be economical when only one job is to be done. The more it is used for various purposes, the more economical it becomes.

1.12   Possible elimination of single-purpose machines

It is neither possible nor economical to dispense with every single-purpose machine when using punched card machines or electronic data processing systems. It has, however, already been demonstrated that, both from the organizational and economical point of view, the purchase of some expensive specialized machinery can be avoided.

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1.121 Addressographs

The above-mentioned applies, for one, to addressographs which consist of stamping, printing, and accessory units. When large-sized installations are used, specialized personnel is needed to operate them. The alphabetic, fast printing tabulating machine or a high-speed printer, in the case of automation, can do the work of the addressograph and perform it more cheaply and with greater variability. Proof of this has been given in several German towns for such jobs as the writing of addresses, wage tax cards, summonses for general elections from the register of inhabitants, and lists for purposes of vaccination, school enrollment and conscription. [6])

1.122 Bookkeeping, invoicing, calculating, auxiliary machines

For the most part, the same is true of bookkeeping machines. For some years German authorities have been considering replacing bookkeeping machines by punched card machines throughout the whole of administrative bookkeeping (personnel and material accounts). The experiences so far have been favorable in spite of some difficulties which still have to be overcome in keeping material accounts and we shall probably be able to publish a general recommendation concerning this subject in the near future. The elimination of generally expensive bookkeeping machines and their operators will lead to a reduction of cost. Before buying a new bookkeeping machine, however, it is advisable to determine whether certain jobs which are at present done by bookkeeping machines could be carried out economically by punched card machines or electronic data processing machines, respectively.

This applies similarly to calculating, invoicing and auxiliary machines, which are becoming dispensable to some extent. Proof has been given that punched card machines can successfully replace bookkeeping machines for assessing and leying local taxes (real estate, trade and other municipal taxes). The same applies to the calculation and payment of salaries, wages and maintenance allowances (elimination of bookkeeping machines in the salary and wage section of the personnel department), to the calculation of welfare allowances and pensions (elimination of bookkeeping machines in the welfare and pension claims departments), to cost accounting (elimination of bookkeeping machines in public institutions) and to consumption billing (elimination of bookkeeping machines in public utilities).

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[6]) cf. paragraph III. 5 of the KGSt report "Das Lochkartenverfahren in der Kommunalverwaltung" (second edition 1959) and the KGSt circular No. 31/1959 concerning the punched card system in local government, section: registration problems.

For reasons of economy, general-purpose machines should be used for various purposes. The personnel situation, moreover, can even make their use for only a few hours per week economical if personnel can thus be saved. This will become more and more necessary with the steady increase of public service.

1.13 Reduced cost for general-purpose machines
1.131 Reduced cost for electronic data processing machines

Automation utilizing electronic data processing machines increases the total cost because of the high price of these installations. This is one of the reasons why automation in German local governments and also in other sectors of public administration is still in the first stages of development.

A new situation arose when manufacturers, partly due to our constant insistence, managed to bring electronic computers on the market at a considerably lower price than before. As a result, the former disparity between purchase prices or rentals of such installations and those of punched card machines and other mechanical devices has changed in favor of automation [7]).

1.132 Production of profitable small-size punched card machines

The manufacturers have supported our efforts to reduce costs by putting small-size punched card machines on the market. Our investigation [8]), which was particularly inspired by the international exchange of experiences with Great Britain [9]), proved that:

1. small-size punched card machines can also be used successfully by municipalities where a conventional punched card installation would not be economical since the volume of work is not big enough.

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[7]) This was also stated for the first time in the KGSt circular No. 7/1960 concerning electronic data processing installations, which completed part IV of the KGSt report "Das Lochkartenverfahren in der Kommunalverwaltung" (second edition 1959). Further development of electronic data processing installations will probably lead in this direction in all manufacturing companies.

[8]) KGSt circular No. 27/1960 concerning the punched card system in municipalities of less than 100,000 inhabitants.

[9]) In Great Britain. small-size punched card systems are widely used in municipalities of less than 100,000 inhabitants, whereas in Germany this is only the case with some public utilities. However, investigations are being made in several local governments of German towns with less than 100.000 inhabitants as to whether small-size punched card systems could be used economically for various administrative purposes. Private enterprise is also strongly attracted by the idea of using such installations, with the result that on several occasions there has been an exchange of ideas with the KGSt.

2. small-size punched card machines can also replace single-purpose machines such as addressographs and bookkeeping machines.

1.2 *Personnel costs*

As far as personnel costs are concerned, the following can be stated:

1.21 Increase of personnel during the period of introduction.

During the initial period punched card systems and possibly also automation will cause an increase in personnel costs. For the sake of safety many users keep their old systems in addition to the punched card system, wherever circumstances permit. This is not always possible nor is it always necessary and parallel operations of this kind should therefore be limited to the shortest possible time. At any event, when changing from conventional punched card systems to automation, parallel operations should be strictly avoided.

1.22 No immediate reduction of personnel with certain jobs

In certain fields of activity (e.g. the payment of salaries and wages, the assessment and levying of taxes) no substantial savings in personnel can, according to experience, be achieved immediately.

1.23 Need of better qualified personnel

Mechanization and automation require more highly skilled personnel, which raises the cost.

It is often difficult to find suitable personnel for the introduction of the punched card system and automation. The bottleneck applies particularly to the position of organizer (operations analyst). It depends on him, as the planner of the new procedure, whether all the possibilities offered by mechanization and automation are fully exploited. It has often been experienced that the important function of this operations analyst is not fully appreciated and that consequently no adequate salary is allocated to him. This puts administration into a difficult situation. In general, local tables of organization either make no provision at all for this position or do not appraise its function accurately. On the other hand, if he is paid in accordance with industrial salaries there is danger that his colleagues who have lower incomes will become dissatisfied and oppose him. The result of this may be that the analyst's work does not reach its full effect. In giving higher valuation to the position of the analyst there arises the difficulty of disrupting the entire organization table of the local government.

The question of cost should also be considered with regard to specialists such as operators of punched card machines and programmers for

electronic data processing machines. This point should not be exaggerated, however, for the importance of machine operators and programmers, who can even be trained from available personnel, declines if there is an excellent analyst.

Difficulties with other machine operators are mostly due to local conditions. Though they perform an important function, nothing above average is generally required of them and fewer cost problems thus arise.

1.24   Release of personnel

Personnel costs can be reduced if the introduction of punched card machines and electronic data processing systems releases personnel previously employed on office machines, such as addressographs or bookkeeping machines, calculating machines, etc. or on manual work.

1.25   Real personnel savings

In the long run, mechanization by means of conventional punched card machines and automation lead to a saving of personnel and thus to a cost reduction; some people, however, expect exaggeratedly great financial advantages. Many people outside of public administration are afraid of its being overstaffed (the so-called Parkinson's Law). Their first question, therefore, is how much personnel can be saved in the long run through mechanization and automation. The same question is asked by those who are employed in public administration but are not familiar with the subject of mechanization and automation. Both assume that a saving of personnel will lower administrative costs; depending upon the answer, the rentability of mechanization and automation is regarded as proven or not. It is impossible to accurately calculate the actual reduction in personnel costs after a short time, it can only be estimated. An exact calculation cannot be made until some years have passed. Then it will be shown that a reduction of costs can be achieved, as has been convincingly demonstrated in several German towns. Where there was no such reduction this was usually due to organizational mistakes, such as insufficient preparation of the procedure, lack of balance for peak loads, and too much use of single-purpose machines in addition to punched card or electronic data processing machines, especially as a result of unsatisfactory cooperation between the departments concerned.

2.   "Can the work be done more quickly?"

2.1   *Punched card machines*

One of the essential reasons why punched card machines were built was the desire to do jobs more quickly, and undoubtedly this was achieved by new machines and installations. There is, however, a great difference

between conventional punched card machines and electronic data processing systems. It is based on the technical principle according to which these machines are built. The mechanical or electromagnetical principle of punched card machines sets an up er limit to the speed of operation. Nevertheless, it has been found that these machines also increase work speed considerably. This applies to the individual units belonging to the basic equipment of a conventional punched card installation such as punches, verifiers, sorters, collators and tabulating machines.

2.2 *Electronic data processing machines*

In the field of electronic data processing systems, calculation speed could within ten years be increased from some hundred operations per minute to 500,000 operations per second. High performance installations of this kind are designed and built because they are needed in practice and the exceedingly high rentals are paid because for some tasks these machines can be used economically in spite of the high cost. We may be sure that the demand for high speed is often exaggerated. In local government qualified high-speed installations of this kind cannot be used economically. Considering the present tasks in this field, installations of considerably higher speed than conventional punched card machines, but not nearly as rapid as large electronic data processing systems, are generally sufficient.

2.3 *Higher speed and its consequences*

By means of general-purpose machines the work can be done more quickly. The more perfect mechanization and automation are, the more rapid is the flow of operations. In spite of higher speed there is also greater accuracy. Errors can either be avoided more easily or discovered more quickly. An important prerequisite for more rapid work is the elimination or reduction of fatigue; in this respect manual work cannot be compared at all with machine work. Operators of single-purpose machines are usually more easily tired than are the operators of punched card machines or particularly of electronic data processing systems. An exception may occur, however, where punching is concerned.

3. "Can the work be done at all by traditional methods?"

By traditional methods is meant manual procedures and mechanization through other than general-purpose machines. This question cannot be answered for local government in general.

3.1 *Problems of size*

This matter must not be generalized. Local circumstances, especially the size of the administration concerned, are of decisive importance.

In Germany we have classified our cities into eight size groups in order to properly obtain and evaluate investigation results. This classification includes all cities from a million to 10,000 inhabitants. Municipalities of less than 10,000 inhabitants are not included in our investigation because their problems of organization and rationalization are predominantly of local significance. Moreover, the administrative work in these municipalities cannot, as a rule, be handled economically by using modern mechanization and automation equipment,for the punched card system and especially automation require the existence of a mass of recurring tasks. The larger a city, the more voluminous these tasks. We have found, in regard to volume work, that cities of more than 100,000 inhabitants can use conventional punched card machines economically, whereas electronic data processing machines can be used successfully in cities of more than 200,000 inhabitants. Small punched card machines can be utilized in cities with less than 100,000 inhabitants down to about 20,000 inhabitants. These are very rough figures and should be closely examined in an individual case because of the differences of local conditions.

If these municipalities do not change to the punched card system or automation it certainly does not mean that the administration will cease to function. The work can still be handled at present by using other mechanical means, but with the increasing shortage of personnel (both in quantity and quality) this will become more and more difficult. As a result of this situation these municipalities will then be forced to consider methods of how to overcome these difficulties by modern means of mechanization or automation.

3.2   *The problem of obtaining objective knowledge*

It is characteristic of automation that in addition to mass work it also handles problems which cannot be solved by traditional methods at all and which either cannot be solved by punched card systems or can only be solved by them inadequately or uneconomically. The question is whether these kinds of problems exist in local administration. Conditions here are somewhat different from those in industry, for in the latter the mere threat of competition makes the constant acquisition of better knowledge and the utilization of new ways of obtaining this knowledge imperative. This argument does not apply to local governments. However, a similar situation exists, for example, in the field of general administration (staff problems), in the treasury, the building department, or in public institutions (such as hospitals or stockyards), and in transport enterprises and public utilities. The leaders of local government are also confronted with the question of whether they should change from a subjective way of thinking

or from more guessing to exact knowledge in order to make better decisions. The collection of data and its rapid, thorough and analytical, processing by means of electronic data processing machines provide the basis for these decisions. This necessity will make itself felt more and more just as will the lack of objective knowledge by community leaders. In the long run, they will scarcely be able to ignore these modern possibilities if they consider the significance of the municipality for human society. The result will be scientific public administration corresponding to industry where the aim is scientific business management (see paragraph 1.3).

4. "Are the employees still willing to perform certain jobs?"

Mid-20th-century man is subjected to drastic changes. The age of technology is not passing him by without leaving its traces. Many people resist this development and endeavour to cling to the past. However, there are more people who make use of the possibilities offered by modern technology, i.e. they do not want to be excluded. It is well known that employees who for years have worked with a punched card system think back uneasily on the time when they had to do the same work by hand instead of by machines. This attitude does not remain unknown and more and more people who still have to work manually or with inadequate machines will say that they, too, would rather work with modern machines. This is quite logical. It may differ from place to place and certainly depends upon the stage of intellectual development of the people. However, it must be taken into account and by and by it will make itself felt everywhere. The time will come when employees in public administration will neither be willing to perform certain jobs manually nor with inadequate machinery.

4.2 Lack of suitable personnel

It must be admitted that there are also some jobs in the punched card system and automation which are not popular because they are considered monotonous. Many operators of specialized machines are reluctant to change over to the machine room of a conventional punched card installation. Shorthand typists often refuse to take over the duties of a punch or verifier operator. For these tasks one has to resort to personnel whose former work has no connection with public administration, such as shopgirls. Fortunately, these people often regard employment in public administration as a social advancement. Nevertheless, finding punch and verifier operators, particularly for local governments, still is a bottleneck, the surmounting of which presents a serious problem to some municipalities.

4.3 *Demand for improved data input*

For this reason [10]) the question of how the necessary number of such personnel can be cut down by different kinds of data input becomes more urgent. Unfortunately, the manufacturers have not yet succeeded in providing solutions which local governments can appreciate as convincing and economical. However, their efforts are going strong on so that one day technical development will also find a satisfactory solution to this question.

5. "Which jobs can be mechanized and automized?"

In connection with machine load, a distinction is made in German local government between bulk jobs and supplementary jobs.

5.1 *Bulk jobs*

Bulk jobs are regularly recurring, homogeneous, uniform, time-consuming operations which can make the utilization of punched cards systems economical. The limitation depends on the size of the local administration and of the installation applied. They include among others:

> Bills for transportation and public utilities.
> Assessment and levy of taxes.
> Administrative bookkeeping.
> Operating accounts within operating statements of public institutions, such as hospitals and stock-yards.
> Calculation of welfare allowances and pensions.
> Statistics.
> Payment and accounting of salaries, wages, and maintenance allowances.
> Store accounting and inventory.

Bulk jobs also include those operations which are done at less frequent intervals, for instance annually, such as the writing of summonses for a general election and of wage tax cards from the register of inhabitants.

5.2 *Supplementary jobs*

Supplementary jobs are administrative jobs which are performed with the aid of punched card machines or electronic data processing installations, if these machines and installations are available in the local government; in their absence these jobs would be done on other machines.

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[10]) The other reason is the increased speed of data input, as it would no longer be necessary to read and punch the data from source documents.

They include among others:

> Compilation of vaccination and school enrollment lists.
> Conscription.
> Budgetary handling of debt service and endowment proceeds.
> Land registers.

5.3 *Bulk jobs and supplementary jobs in relation to punched card systems and automation*

Bulk and supplementary jobs can be accomplished with the aid of both punched card machines and automation. The transition to automation is necessary when the volume, complexity or diversity of the work can no longer be handled by conventional punched card machines, or at least not economically. It is a conclusive fact that the more the capacity of work is increasing the shorter is the time necessary for preparation and change-over.

6. "What are the advantages and disadvantages of purchasing machines or delegating the work to private enterprise?"

6.1 *High Fees*

Fees in the service bureaus of manufacturers are high. When the work reaches a certain volume a study should therefore be made as to whether the purchase of equipment would not be more economical. This can even be the case when one's own installation can only be partly utilized.

6.2 *Founding municipal machine centers*

The situation is different if the work is not delegated to the service bureau of a manufacturer but is done at cost price by a central organization of several associated local authorities. This method is particularly satisfactory when lack of personnel prevents a separate punched card installation. It can also be recommended in such cases where an individual local government cannot operate a punched card installation economically.

In Germany a number of public utilities united in this way in order to run a common punched card installation to perform consumption accounting, which measure proved to be satisfactory. A similar union of several local governments, however, has not yet been practiced in Germany, though it too suggests itself. This idea, however, must still

be discussed more thoroughly. In the future those responsible for economical and organizational questions will certainly regard it as a matter of course for the punched card system and its technical possibilities plainly point to such a conclusion [11]).

6.3 *Additional advantages of owning an installation*

The advantage of owning an installation is that the machines can also be utilized for supplementary jobs. If, on the other hand, the work is delegated to outside undertakings whose fees are very high, supplementary jobs continue to be done with existing methods.

6.4 *Purchasing or renting machines?*

One disadvantage of owning an installation may perhaps arise from the difficulty of deciding whether punched card or electronic data processing machines should be bought or rented. Many people are afraid that their decision to purchase may prove a mistake and, as a result, do not come to any decision at all. Renting machines will, on the other hand, seldom be a wrong decision. In our opinion, renting has the following essential advantages: the maintenance service provided by the manufacturers is better than in the case of purchase, because it is in the interest of suppliers that the machines be kept in good condition and that lost time be kept as short as possible; machines which are out of date can easily be replaced by others; organizational and economic disadvantages which might arise from retaining a machine too long can be avoided. These advantages outweigh the disadvantages that, in the long run, renting incurs higher costs than does the purchase of machines. Experience has shown, however, that in general people are reluctant to replace machines too rapidly. The change-over to new machines entails so many organizational and personnel difficulties that this step is sometimes delayed longer than is perhaps advisable. On the other hand, it is not to be expected that machine development will proceed more slowly in the near future, for the human mind is constantly striving to improve what already exists. Both manufacturers and customers are promoting these efforts, the former spurred by competition, the latter by the desire to have more and more efficient machines at their disposal.

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[11] In Belgium, the Netherlands and the U.S.A. such unions of local governments are said to have proved successful. In Germany regional punched card machine centers, which have been established by the state, are successfully used for the calculation and payment of maintenance allowances and the solution of various problems common to several local authorities.

6.5 *Legal difficulties in connection with service bureaus*

Legal difficulties may arise if a private service bureau programs an administrative problem and supervises its mechanical processing. For this reason the service bureau can only be entrusted with the solution of problems which have been programmed by administrative employees and are processed under their supervision. Any legal objections are thus removed, but the main burden of the work lies on the administrative personnel. This counts against the utilization of a private service bureau.

7. "What are the advantages and disadvantages of introducing mechanized and automized systems with regard to their organizational and psychological effects?"

7.1 *Advantages and disadvantages*

It is an advantage that operations can be done more rapidly, more productively and more accurately, which is an important fundamental condition for the simplification of work. A further advantage is that in many cases it is only by means of mechanization and automation that the increased volume of administrative work can be handled at all. Here, the objection may be justified that instead of looking for means of surmounting an increased volume of work it would be better to prevent the work from increasing. Experience shows, however, that the one is impossible without the other. In our daily work we should, of course, strive to prevent administrative work from increasing wherever possible. Nevertheless, it is true that a community of today, with its complexity, urge to perfection, welfare tendencies and other measures for public benefit, cannot avoid such an increase in spite of all efforts to the contrary. The application of most laws of a nation is left to the town hall where the laws are adapted to circumstances and translated into practice. It is wrong to regard this phenomenon as a necessary evil of bureaucracy [12] and to believe that it should be removed by a better bureaucracy or by applying drastic measures. In our opinion, it seems better to look for ways and means of restricting this increase to tolerable limits. Some of the following may prove effective:

1. Encourage local government officials to become cost conscious.
2. Appropriate training of the new generation of officials.
3. Inform the population of the fact that every demand on public means will lead to extra administrative work.

[12] Cf. Freyer on the situation of bureaucracy in the middle of the 20th century, special print of KGSt information, June 1961.

4. Make serious attempts to accomplish the work with modern machines.

5. Laws and decrees in accordance with work and equipment (automation).

7.2 *Necessity of reorganization*

In particular, the method mentioned under 4. compels local governments to reorganize, which may be regarded as an advantage. This reorganization, particularly the one necessary for automation, makes very great demands of the municipal executives and the personnel of offices subordinate to them. The most essential demands are enumerated below:

7.21 Readiness of administrative executives to make decisions.

It is not enough that only specialists should become fully acquainted with the principles, the technical structure, the method of operation and the possibilities of punched card and electronic data processing installations. Leading executives or the local council, respectively, must decide whether the investment of money and labor is justified.

It is a disadvantage that many executives today, because of their being overburdened with other tasks, shrink from this new burden. They thereby overlook the benefits that could result for themselves after the initial period.

It is also on the level of subordinate officers that a fear of drastic changes in administrative methods can often be observed. Active cooperation of all personnel employed in this field is, however, a prerequisite for the success of automation.

7.22 Cooperation of auditors

It is essential that any objections of the auditors against the new procedure should be dispelled for the requirements and possibilities of auditing can be regarded as complied with.

It must be admitted that the punched card system and automation subject auditing to drastic changes. Auditing is only possible in regard to the input of data into the machine. It cannot interfere with actual machine work because this is carried out automatically and logically. It is therefore necessary that the auditors should insist on the observance of all safety rules which are required for correct input of data. For this reason, auditors must have sufficient knowledge of the punched

card system and automation. Permanent and close cooperation of all parties concerned before the work is programmed and put into the machine is of great value.

7.23   Change of attitude

As to automation, the old attitude of hoping to get through with little or no change of methods must be cast aside for the object of automation is not to replace old machines by new ones. All the opportunities which automation offers must be realized. If efforts are not made to do so, the installation will not be utilized to its fullest extent.

7.24   Organization of team work in connection with the punched card system and automation

It is essential to predetermine the discovery and correction of wrong decisions and errors in the new procedure. This includes a clear, accurate and thorough analysis of methods and procedures which are to be applied. For this purpose, the formation of a team equipped with appropriate authority to act is required, for the procedures in all offices concerned must also be changed. Authority to act is of decisive importance because otherwise the new ideas cannot be carried out successfully. Any differences of opinion should be settled by leading executives who are entrusted with the successful performance of the new procedure.

It is a disadvantage if the work of the team which is responsible for correct performance of punched card operations and automation is not yet valued, or cannot be valued, adequately. The importance of this situation has not yet been fully recognized in public administration whereas industry has mastered it completely. This leads to the change-over of personnel from public administration to industry, to the detriment of local government whose salary and wage scales and collective bargaining contracts prevent the payment of wages similar to those paid by private enterprise. Nothing is more dangerous to a punched card or computing department than frequent disturbance or interruption of work by personnel changes or lack of qualified personnel.

On the other hand, it must be considered as a disadvantage that the fundamental change which is the logical consequence of mechanization and automation can disrupt the harmony in public administration. It is quite natural that the above-mentioned operations analyst should demand a salary exceeding the usual scales of local government. Today there is still such a great demand for these specialists that they can always obtain better paid positions in industry where working possibilities and working conditions are more satisfactory. On the other hand, it is

understandable that local government employees with long years of service, who are perhaps much older than the analyst, should refer to their loyal service in public administration and the conscientiousness with which they have satisfactorily performed their work.

Their disappointment will be sufficient reason for them to oppose the new procedure, which can have very damaging effects on the introduction of the new system. Because of its universal character, it requires understanding and cooperation not only of those directly involved, but also of those who have to prepare the work for the installation. Especially do the heads of the individual departments have to revise their way of thinking and provide the machine with optimal work.

7.25   Reassignment of personnel

Mechanization and automation require higher qualifications, such as organizational and technical insight, critical judgment and abstract thinking. These are qualities that not everyone possesses and that many try in vain to acquire. Thus, the question arises as to what will happen to those employees whose work has been taken over by machines. For this reason, some people are sceptical about mechanization and automation or even reject it. Their suspicions, however, are exaggerated.

Though the punched card system and automation are making their way in public administration, progress is very slow. Thus, it is a gradual process which does not confront local governments abruptly with difficult personnel problems. Employees who are released as a result of mechanization and automation can be used in administrative positions for which additional personnel would otherwise have to be hired. As a consequence of reduced working hours the loss of work must be made good by increased productivity.

In Germany conditions have radically changed because of the present shortage of personnel. Today many employees see an advantage in leaving local government for better paid positions in industry or do not even think of entering local government. Many sectors of our public administration are suffering from such acute labor shortages that the use of a machine, without regard to its being economical, can be justified if it helps to relieve this lack of personnel [13]. This may be just a temporary phenomenon, and may change to the contrary. Since the future is unknown to us, it seems reasonable to plan now on the basis of present conditions.

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[13]   We know of a similar situation in Great Britain where an electronic calculating punch is already regarded as economical if by working only a few hours per week it can save several bookkeepers.

Punched card systems and automation release employees for more interesting jobs than routine work and these employees can thus better utilize their qualifications. By promoting suitable employees to more important and better paid positions, a contribution is also made to the general prosperity of employees. This has an important psychological effect in that the work is done more eagerly and with more interest.

7.26 Achievement of cooperation

Those specialized in the operation of single-purpose machines will only give up their jobs reluctantly. However, this is necessary for the introduction of general-purpose machines. The result is that people who previously worked almost independently are now becoming dependent upon one another. As this idea is intolerable to some people, the necessity of cooperation must be particularly pointed out to them.

New procedures involve disturbance and changes. The understanding and good will of all parties concerned are needed to realize this and to cooperatively overcome the initial difficulties as soon as possible. The importance of cooperation in mechanization and automation cannot be emphasized enough.

Unfortunately, there are also employees in public administration who, without being familiar with mechanization and automation, reject these procedures merely because they are new. In many cases they do not look for possibilities of cooperation but rather for reasons to discredit the new methods. Thus, in trying to cover up their own shortcomings these people can be extremely obstructive. Those in charge must therefore give special attention to them. If necessary, they must be given another job.

7.3 *Surmounting the difficulties*

It is a matter of importance that the above - mentioned organizational and psychological effects are realized in time and are overcome where they are obstructive to mechanization and automation. In individual cases intelligence, tact, persistence and power of decision are required from all parties concerned in order to arrive at satisfying solutions. These are qualities which may be called the art of administration, which includes also theoretical knowledge, technical understanding and objective recognition of the general situation. This is applied science and should be a spur to those responsible to handle this matter in public administration with energy and readiness of action.

8. "What other difficulties must be overcome?"

Public administration is slow in using the modern means of mechanization and automation. The question of what difficulties are still impeding their introduction is therefore quite natural.

8.1 *Difficulties from within*

The reason for the appearance of difficulties within the respective local administration are listed on the preceding pages. These difficulties can be overcome, but this will take some time [14]).

8.2 *Difficulties from without*

If difficulties arise from without, i.e. the reasons for them cannot be found in the respective local administration, the following hints may be useful:

8.21 Legal objections

Administrative mechanization and automation have long been reserved to such people who came into touch with these modern means of organization as organizers, mathematicians, business administrators, economists and the like. Lawyers have done less to become acqainted with them and so, in many cases, did not realize their importance. Some lawyers regarded them only as the effects of the so-called office reorganization, which did not concern them. Others felt obliged to point out the danger of communicative errors in electronic data processing machines and to raise general objections against the reliability of machine work and in connection with this, objections concerning administrative law. In addition to these, constitutional and political objections were expressed [15]).

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[14]) Compare the development in the German local governments as described in the KGSt report "Das Lochkartenverfahren in der Kommunalverwaltung", first edition 1957, paragraph I. 3.1, second edition 1959, paragraph I. 3.1 and in the KGSt circular No. 13/1961 concerning the punched card system in local government, section catalogue.
[15]) Forsthoff hints at them in his publication, "Rechtsfragen in der leistenden Verwal·tung", in *res publica,* contributions to public law, volume 1, Stuttgart, 1959, on pages 57 and following. Zeidler discusses them in the publication, "Über die Technisierung in der Verwaltung", Karlsruhe, 1959. Replies to Zeidler's publication, which are in accordance with our opinion, can be found in Maasz, "Zur Frage der Haftung und Verantwortlichkeit im Bereich der automatischen Datenverarbeitung", published in the "Deutsches Verwaltungsblatt", 1961, pages 7 and following, and in Müller-Heidelberg's "Verwaltungsrechtliche Probleme des maschinell hergestellten Verwaltungsaktes?", published in the "Deutsches Verwaltungsblatt" 1961, pages 11 and following. Zeidler partly recalls his previously expressed objections in a further reply, printed in the "Deutsches Verwaltungsblatt" 1961, pages 493 and following, admitting that the whole problem is too much *terra incognita.*

8.211 Objections against machine work and associated objections concerning administrative law.

Objections against machine work as such and possible administrative errors which may arise as a result of it tend to the following direction: "The machine provides incorrect results, it is operated incorrectly, or it is programmed incorrectly [16].

Again we shall confine ourselves to general-purpose machines. It goes without saying that an interruption of the working process by a functional breakdown, i.e. by a breakdown of one or more elements of punched card machines or electronic data processing systems, should be avoided. The problem of ensuring reliability of machine elements is an aim which the manufacturers are constantly and conscientiously trying to achieve.

Today the argument of incorrect machine work can already be called rather improbable considering the perfection in design, construction of the individual elements and the built-in safety devices (checking functions). "In principal, incorrect results simply cannot leave the machine without having been discovered and indicated by the built-in checking circuits" [17]. This is achieved by the principle of "self-checking", i.e. by the faculty of the machine to detect errors and to correct them automatically.

In order to ensure correct performance of the checking functions a set of test cards is run through the machine at the beginning of every job. These cards are of a kind which use all elements of the machine. Deficient elements are discovered at once and can be replaced in order to ensure reliable functioning of mechanical error detecting devices. It also happens quite often that program decks, which have intentionally been punched with wrong data, are entered into the machine. If these errors are indicated, correct performance of the checking functions has been proved.

It is hardly imaginable that errors should be made in the technical operation of punched card machines or electronic data processing systems. In order to run these machines the operators have to do certain manual work. With punched card machines and electronic data processing installations this work is of a kind to make errors practically impossible provided the personnel has been sufficiently trained. Machine

[16] See Forsthoff in "Rechtsfragen der leistenden Verwaltung", page 61.

[17] Cf. "Die Bedeutung der nicht bewertbaren Einfluszfaktoren bei der Verwendung von Lochkartenmaschinen", published in "Betriebswirtschaftliche Blätter für die Praxis der Sparkassen und Girozentralen", 1961, No. 9, pages 67 and following.

operation, therefore, requires good personnel, though their qualifications need not be above average. Employees of average standards are also capable of operating punched card machines and electronic data processing systems correctly. However, if an error in machine operations is sometimes made, this is human and has nothing to do with the machine as such (the same applies to other devices and machines). As against any third party, the employer is liable for these human errors.

Incorrect programming is a more serious problem. Programming is also an activity which has nothing to do with the machine. It is purely human work. Only the programmer is responsible for the correctness of the program which is put into the machine. With an incorrect program the machine is bound to produce incorrect results, for it cannot correct an incorrect program by itself, as it cannot think. If the program is correct, however, the machine performs its job more rapidly, more safely and more objectively than does a human being, who would have to do the same job by means of his hands and his mind. With correct programming the result, which may also be an administrative act, is therefore more reliable than a manually obtained one. When the programmer makes a mistake, this is the same as if a human being made a mistake in manual work. The responsibility for it must not be passed on to the machine, but must be with the human being, as in the case of manual work. This means that a human being must be held liable for an incorrect administrative act, i.e. the employer of the programmer as against any third party. The same applies to operators of conventional punched card machines.

Until now, one possible source of errors has not been mentioned, namely, that a job cannot be carried out in time because of a machine breakdown. This may lead to unpleasant delay, which the people who suffer from it will not put up with or, if so, only reluctantly. These difficulties can be reduced to a minimum or even removed completely if there is another machine (e.g. a second tabulating machine) for emergency cases. This is possible provided that the installation is not too small [18]). If there are several sets of conventional punched card machines, breakdowns can thus be bridged over without any difficulty. As to automation, the matter seems to be more difficult because in most cases there is only one machine set of an electronic data processing installation in public administration as purchase or renting costs and efficiency are higher. Here the deficiency rate is much lower because of the technical principle of the installation (no mechanical or electromagnetical way of operation but electronic data processing, utilization of transistors instead of valves). It is about $1\frac{1}{2}$ %, i.e. three hours, at a working time of 200 hours per month. This requires a well-organized, quick-

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18) See the respective recommendation in the KGSt report "Das Lochkartenverfahren in der Kommunalverwaltung" (second edition 1959) on paragraph II. 3.412.

working maintenance service as is provided by well-known manufacturers.

In connection with legal objections, in administration the question has been raised whether the problem of liability should be re-defined. This question is based on the assumption that the work of the machine no longer creates an administrative act, but rather an administrative product. which is not sufficiently covered by liability in its present form. It can be taken from the above-mentioned that at the present stage of technical development, liability as it has been defined until now is sufficient. Incorrect machine work is not likely to occur, as the built-in checking devices are too reliable. Any possible mistake will result from human work; the machine remains a mere tool. That is also why, in the case of administrative mechanization and automation, a human being can be held liable, and for him, his employer.

The situation will require different judgment when the machine produces creative ideas, as has been predicted for the future by experts in cybernetics [19]. "The self-thinking computer will certainly not arrive for some generations to come though it is probable that, on principle, the next generation will already have a conception of it" [20].

8.212   Constitutional objections

Constitutional objections are expressed on the assumption that the legislators would be degraded if they had to conform to the machine; this would be intolerable. These are perhaps not so much constitutional as sociological and psychological objections. The legislative situation of today is unsatisfactory, for as a rule legislators do not think much about the further increase of administrative work caused by the passage of new legislation. The execution of laws, however, requires men, unless it is possible to delegate the greater part of this work to machines. Such should be our aim because an increase in administration is an evil which can only be accepted reluctantly. The demand for less administrative work has been recognized for years by legislators and members of Parliament, although they do not see how this can be accomplished. Should they take the possibilities of machine work into consideration, however, the result would not be an intolerable conformance to a machine, but the acknowledgement of means that are not at present available, but which are suitable to the task. Efforts are also being made to overcome the "problem of legislation suitable for automation" (see above II 7.1).

In addition, constitutional objections are raised on the grounds that the federative principle and the principle of local self-government are violated

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[19]   Cf. Schachtschabel on automation in economy and society 1961, page 20.
[20]   Cf. the American, A. K. Watson, who has first-hand knowledge of the technical development in this field. His ideas on information techniques and the economy of the future can be noted in "Rationalisierung" 1961, page 29.

because the machine is bound to bring about a kind of centralization. In this respect, the federative principle may be looked upon as exaggerated in Germany. It represents an anachronism because, on the other hand, all political parties regard European integration as a desirable political object. The principle of local self-government is not violated if several municipalities unite voluntarily in order to run a common punched card machine center, or a computing center in the case af automation, and thus perform their administrative work more economically, accurately and rapidly. The same is true if, for the purpose of econimcal machine utilization, the individual departments of a local government are made to delegate their work to the central punched card office or the computing center, the suggestion for which may come from without. In the field of organization it has been proved that experiences of general value can be obtained and realized in practice. From an impartial point of view, these experiences cannot be right in Hamburg, wrong in Munich and right in Chicago. If they are not utilized in some places the reasons can only be of a subjective or emotional nature and are not likely to stand up to scientific research.

Thus, the assumed violation of the federative principle as it is established in the German constitution does not concern local governments. As to administration of the state, a violation of this kind cannot be discovered either. If, for instance, old age pensions in Germany are calculated uniformly as a result of mechanization in social insurance, this is a contribution to legal security which is probably approved of by pensioners all over the Federal Republic. The same applies to the maintenance of war victims. Furthermore, regional differences can be programmed. Therefore, we are of the opinion that the federative principle is not violated by mechanization or automation, but that the law is adhered to in a way corresponding to the fundamental idea of our constitution.

8.213   Political objections

The above-mentioned will also remove political objections which are raised on the ground that objectivity in governmental work and paralyzing the organization by means of automation (information, technique) are a danger to democracy. In the first place, an objective way of thinking can only be regarded as an advantage and if machines help us to achieve this aim, we should make use of them. The possibilities are open to both the government and the opposition. Objective information, as it is provided by mechanical means, could raise political discussions to a higher level; this could only be to the advantage of democracy. It should not be forgotten that though at the present stage of technical development electronic data processing machines are able to retain many more "memories" than the human brain, it is still

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impossible to program ethical, moral and political values. Thus the human mind still has wide room for action. It may be that the increasing perfection of machine work will create a relationship between men and machines which is as yet unimaginable. The more perfect future machine work will be, the more distinct the limitation of the human mind may become. Even this is still unimaginable to us though the accomplishments of already existing translating machines give us a faint idea of the qualities which a machine may arrive at by further development. The machines of today cannot be charged with this development. We should perhaps refrain from delaying the progress of human development as it is offered to us by machines, which were conceived by human ideas, by objections which in the long run will not stand the test.

8.22   Difficulties resulting from a rapid process of mechanical development

8.221   "Automation" understood

The second half of the 20th century is sometimes called the "age of automation"[21]); this is by no means exaggerated. However, the advantages connected with this development are also accompanied by disadvantages. The term "automation", which may easily be misunderstood, exerts an almost magical attraction so that it is also used in such cases where automation is quite out of the question. The reasons are numerous. For one, the word "automation" has become a kind of slogan for many people who mostly have but a vague idea of what it is. Manufacturers of non-automatic machines cannot resist the temptation to use this word for their products for by so doing they try, at least theoretically, to indicate a connection to further technical development. They also want to satisfy those customers who are willing to buy any machine if only the word "automation" is in some way or other contained in the name of the product. Furthermore, many manufacturers try to indicate the connection by developing their own machines which have a tendency toward automation, but which are not able to meet the requirements that are put on general-purpose automatic installations. Thus it is no wonder their products are often rejected.

It is natural that man of the second half of the 20th century, who is confronted with the question of obtaining proper machines, should want to meet the demands of his age. An interesting touchstone is the industrial fair which takes place every year at Hanover. Whereas in 1954 hardly anybody talked of automation, and manufacturers of punched card machines only cautiously mentioned electronic data processing machines,

[21])   Among others, see Brinkmann on men and technology in the age of automation in "Refa-Nachrichten", journal for work studies 1959, No. 6, page 169.

which were then used in the United States but were not presented at the fair, the same fair in 1961 was almost completely devoted to automation. Several installations of this kind which are purchased or rented more and more were shown. This illustration shows best how conditions and opinions have changed within a few years. A thing which in Germany was completely out of consideration in 1954 has almost become a matter of course today.

8.222 Testing the rentability

It is true that before machines are bought the matter must be thought over very carefully because most customers are anxious to get the most up-to-date and efficient machines. There is nothing to say against this provided that it is also determined beforehand whether it would be economical to introduce machines [22]) at all and whether general-purpose installations would be better suited than specialized single-purpose machines.

However, the purchase of urgently needed machines should not be postponed again and again only because the prospective purchaser cannot make up his mind what to buy. Today there are people who regard the conventional punched card system as out-of-date and are only interested in electronic data processing machines. Such an opinion may be justified in special cases, but for many firms and local governments profitable utilization of electronic data processing machines is out of the question, considering the present technical development. Many smaller firms and local governments are even unable to profit by conventional punched card machines and have to resort to small punched card installations if they want to use general-purpose machines.

8.223 Lack of small-size electronic data processing systems

In the field of electronic data processing machines, there is still a lack of small-size electronic data processing systems [23]). We are urging the manufacturers to produce machines of that size which are still general-purpose machines, rather than the limited in use single-purpose machines.

8.224 Comparison of systems and working principles

Further difficulties arise from the fact that the manufacturers of conventional punched card machines have essentially remained constant [24]),

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22) Cf. KGSt circular No. 1/1959 concerning mechanization in local government.
23) That is why the KGSt report "Das Lochkartenverfahren in der Kommunalverwaltung" (second edition 1959) in its catalogue on available electronic data processing installations (pages 185-189) only mentions "medium-size" and "large" installations in order to show that there is a gap which should be filled. This distinction, though methodically incorrect, is quite to the point.
24) BULL (French), IBM (American), ICT (British) and REMINGTON-RAND (American). Small-size punched card systems are produced by IBM and ICT.

whereas the number of suppliers of medium-size and large electronic data processing machines is becoming greater and greater [25]).

In the case of conventional and small-size punched card installations a comparison of systems can still be performed by comparing technical details and costs of the individual products [26]). With automation such a comparison of systems is no longer possible; one has to be content with a comparison of the working principles according to which a certain job is done.

Although this may be regarded as a difficulty, it is not really so, for in addition to the precision of machine equipment, the nature of the problems to be solved and the respective efficiency of the machines are the decisive factors for a proper choice. Here, a rapid-working maintenance service is of special importance because of possible machine breakdowns (see II 8.211).

8.225   Mechanization or immediate automation

Finally, it is difficult to decide whether automation can directly follow manual or single-purpose machine procedures. The usual development leads from manual processing or mechanization by means of single-purpose machines to mechanization by means of conventional punched card machines and ends up with automation. However, it is also possible to skip the intermediate stage of conventional punched card machines and change to automation immediately. The advantage in this case is that reorganization is necessary only once. As was mentioned before, automation does not merely consist in the exchange of machines; the most important thing is a complete reorganization. The method which may seem simple is not always proper. Those who are without experience in the field of conventional punched card systems will probably find it hard to program problems for automatic data processing machines. These difficulties will be less grave after some experience with punched card machines has been attained. Opinions on the proper method therefore are divided.

It is, however, possible to master these difficulties too. The usual way is to begin with conventional punched card systems and change to automation afterwards.

[25]   The main competitors are BULL, BURROUGHS, ELECTROLOGICA, IBM, ICT, NATIONAL, OLYMPIA, REMINGTON-RAND, SIEMENS, STANDARD ELECTRIC LORENZ, TELEFUNKEN, ZUSE. On foreign markets some more companies are offering their products; as a whole there are about 50 firms of this kind.
[26]   KGSt report "Das Lochkartenverfahren in der Kommunalverwaltung" (second edition 1959) paragraph II 2. 322.

8.3 *Independent advice*

Mechanization and automation in administration are promoted if there is an office which can give advice to the local governments before and during the time of introduction and can point out the possibilities offered by these procedures. This central office should also have the task of working for the removal of legal difficulties that impede the introduction of mechanization and automation. Moreover, it should coordinate the requests of the local governments to the manufacturers; on the one hand it sees that these requests are not so great that they jeopardize the rentability of the product and on the other hand it takes care that the manufacturers have an open mind towards these requests. Among others, these are considered the functions of the Inter-Municipal Bureau for Administrative Simplification (KGSt.) in Germany.

8.4 *Selection and training*

The difficulty of finding suitable personnel for punched card systems and automation is quite obvious in local governments. That is why selection and training facilities must be provided for. Those employees can be taken into consideration who until then performed other administrative jobs but are, according to a general inquiry, willing to take over a new one. Special tests may also help to decide whether these volunteers are suited for this task. If desired such tests are performed by the manufacturers. They are to be recommended because they help to exclude from the start those employees who are quite willing but who are not able to meet the requirements of the punched card system and automation [27].

Furthermore, training facilities must be provided for the personnel who pass the test successfully. In Germany training courses in machine operation are almost exclusively provided by the manufacturing companies and attendance at these courses is indispensable. It does no harm if the training is limited to a special product because the local governments who send the participants are interested in training machine operators or programmers for their respective installations. The manufacturing companies also arrange seminars and introductory courses for those employees in public administration who must be acquainted with the punched card system as such without having to operate or program the machines for themselves. These courses are mostly good but have, of

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[27] Among others, Bright's treatise, "Erhöht die Automatisierung die Anforderung an das Können?" as published in "Fortschrittliche Betriebsführung", volume 7, pages 31 and following, may be quite interesting. Diebold in "Automation im Büro — falsch angefangen", which was published in the same volume, pages 175 and following (180), calls the training of personnel "the basic problem in automation".

course, the disadvantage of being restricted to the products of one company only.

Therefore, independent training is to be preferred on principle. In this respect Germany is still far behind. The American example of calling upon the universities for this purpose may be quite useful but the efforts that we are making in this direction have only just begun.

III. PROSPECTS FOR THE FUTURE

The opinions expressed above are the result of our observations and reflections from many years of practical experience. They do not contradict logic but are an integral part thereof. Even though modern technology often transports us mentally into a new world and thus subjects us to a change that the interpreting mind cannot always follow, we are of the opinion that this does not apply to the present stage of mechanization and automation in public administration. Employees of local governments are not overburdened by it and all organizational, personnel, psychological, sociological and legal problems associated with it can be solved. Thus, the road to be taken in the field of mechanization and automation is quite clear. It leads to the utilization of universal procedures such as the punched card system by means of conventional and small-size punched card machines, and automation by means of electronic data processing installations, which may sometimes replace single-purpose machines. The probable result of this development will be a considerable improvement of efficiency in local government to the benefit of all those who are under its administration. If by 1980 every town hall in the United States of America is to be equipped with an electronic data processing installation, which will then be regarded as natural as telephones and typewriters are today [28]), this may also be possible for Germany and for many other countries, though perhaps some twenty years later. We feel justified in making such a forecast because international exchange of experiences has shown that the United States of America is not far ahead of Germany and other countries in regard to mechanization and automation in local government, as described above.

[28]) Edward F. R. Hearle, quoted by Lowell H. Hattery, *Mechanization and Automation in Local Government* in "Local Government in the United States of America", The Hague, 1961, page 50.
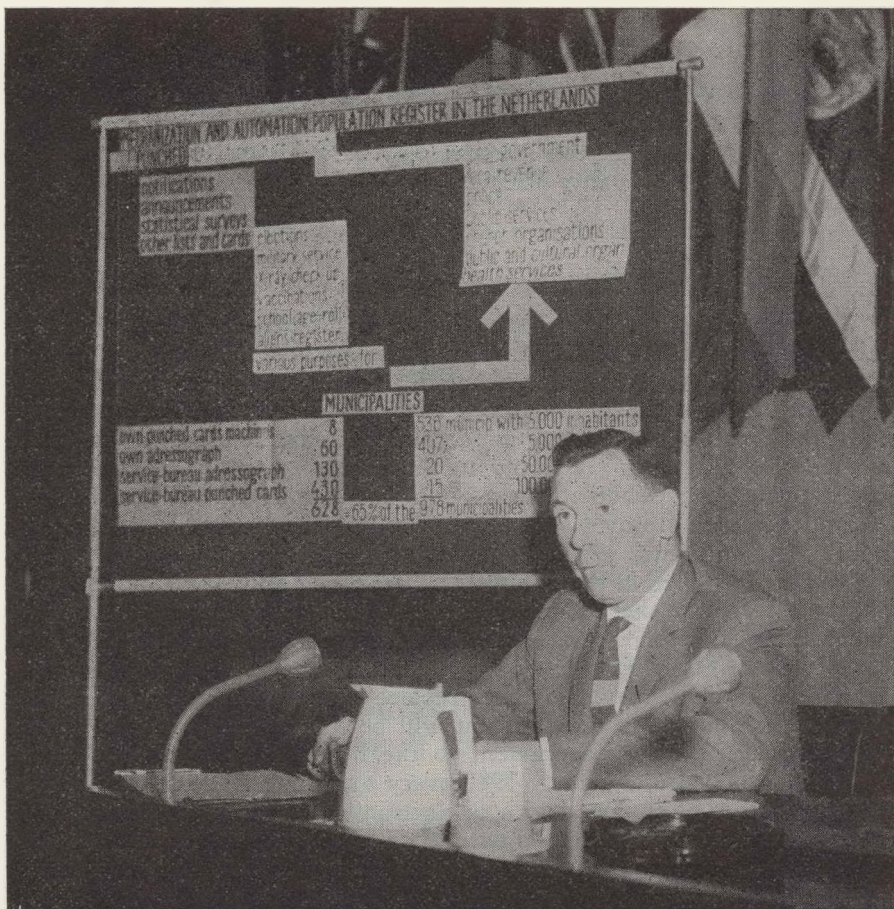
Mr. E. Boer sits before a flannelgraph which visually describes the use of automation and mechanization in the registration of the population in the Netherlands.

CASE STUDY: MECHANIZATION AND AUTOMATION IN THE REGISTRATION OF THE POPULATION IN THE NETHERLANDS

by

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The registration of the inhabitants of all municipalities in the Netherlands is subject to a set of regulations which has been established by the central government. For each inhabitant of a municipality there must be a card on which is stated, in addition to such vital statistics as name and date and place of birth, the inhabitant's religion, occupation, nationality, name of parents, name of husband or wife, if this is pertinent, address, etc. Each individual's card is included in the population register of the municipality in which he lives and should the individual move, his card is then sent on to the new municipality where he is taking up residence. In this way, each individual is, as it were, always accompanied by his card.

The main purpose of this registration is to provide a reliable source of information about the persons residing in their area for the local government administrations. In the Netherlands these total 978 municipalities, of which 536 have less than 5,000 inhabitants; 407 have between 5,000 and 50,000 inhabitants; 20 have between 50,000 and 100,000; and 15 have more than 100,000 inhabitants.

A collection of these registration cards contains a vast amount of information about the inhabitants of each municipality. This information is meant primarily for the local government authorities for revenue, police and social welfare and may be supplied to others, as for instance public, cultural and church organizations, only under certain conditions. Apart from this, information may in certain cases be given to private persons, but only to a limited degree.

For the local administration, the population register of a municipality is the basis for:

a. the sending out of notifications and announcements,

b. the compilation of registers for the town's own administrative purposes,

c. the compilation of statistical surveys of all kinds.

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However, this collection of cards is not suitable for mechanical processing, and therefore whenever certain data are needed for any of the purposes I have mentioned, all these cards have to be consulted and the data copied out by typewriter on to other cards and lists. If one has to do this very often, one naturally starts wondering if there is no other way of transferring these data speedily and perhaps more accurately. Of course, at this point one begins to think of the possibility of using metal address plates or punched cards.

On the whole, the officials of a town clerk's office are called upon to do this copying out work rather frequently. In the first place, there are the administrative preparations for the election of members to the town council, the provincial council and the Second Chamber of Parliament (our equivalent of the U.S. House of Representatives). The members of these representative bodies are chosen in the Netherlands by all the inhabitants who are eligible to vote. In Holland the law stipulates that everyone who has the right to vote must receive a summons card and furthermore, that each voter's name and address must be registered on the voting list which is compiled for his respective election bureau. In the Netherlands we have an election three times in every four years.

Another important job for the town clerk's office is the compilation of the lists of young men who are to be called up for military service. Every year, in every town, the young men who are 18 by the 1st of February of that year must be entered on a register, and those who have been entered must be notified accordingly. This registration is the first step in the administration of the compulsory military service, which is continued centrally at the Ministry of Defence. The Ministry then receives a duplicate of each local military service roll and also a card with further details of the young men who have been registered.

Thirdly: In the years after the Second World War an extensive organization was built up in the Netherlands for checking up on lung tuberculosis. At least once every three years the inhabitants of every municipality are called up individually to have a chest X-ray check-up. Any further treatment is carried out by or in close cooperation with the medical authorities. In this way an efficient organization has been built up to track down centers of contamination and individual cases of tuberculosis so that they can be dealt with and treated in an early stage.

Again, there are still other regulations in the Netherlands which require registers to be kept by the local administration, for instance, a roll for children of school age, for vaccination purposes, for aliens, etc. For all these matters the population register of the municipality is the starting point. The population registers are therefore of paramount importance

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and really form the focal point in the local administration. It may well be said that the data processing of the population register is an ever recurring job.

In considering the use of mechanization and automation we must remember two main principles: first, the number of data which are to be processed must be large and secondly, data processing should take place repeatedly. In view of the size of the municipalities in Holland we might therefore wonder whether there is any future for mechanization in Dutch local administration. However, the developments which have taken place in Holland during the past 12 years show a very different picture. In the largest towns, for example, the scale of the total local administration, that is, the register of the population, the local revenue administration, the administration of salaries and wages, the public utilities, and the medical and health services, is such that the setting up of a limited punched card installation is justified. With this installation the data of the population register can also be processed and in this way our largest towns are doing a very efficient processing job, with very helpful results for the administration.

Of the medium-sized municipalities, many have installed a kind of addressograph with certain selective capacities which is mainly used to process the data of the population register. The quite extensive selective possibilities of this machinery enable the administration to complete their various tasks efficiently. This leaves those municipalities which do not wish or are not able to buy their own machinery and who would therefore not be able to profit from the development of technical aids for administrative work.

However, about 10 years ago two private publishing firms in the Netherlands, both specializing in printing forms and other needs of local administration, decided to start national Service Bureaus. These firms were then given special permission by the central government for data processing of the population registers of what is now almost 550 municipalities. Under the general regulations, use of the facilities of the Service Bureaus are bound by an agreement and reciprocal obligations have been strictly fixed by general rules. In this way a form of service was created for Dutch local administration which we think is unique. One of these national Service Bureaus makes use of metal address plates; the other uses punched cards. I hope you will allow me to confine myself in this exposition to the punched card service.

The significance and function of the population register for Dutch local government necessitate strict rules for the registration of the inhabitants, and there are also centrally prescribed rules for the preparation of punched card registers and for making alterations in these registers.

For instance, the population register may not be removed from the town clerk's office. This means that the Service Bureau cannot do the punching of the cards at one central place; rather this work must be carried out in the town clerk's office. The job is then done by the Service Bureau's punched card operators on the Service Bureau's punching machines, and the town clerk's office need not, therefore, have a punching machine of its own. According to the regulations the punched card register is an integral part of the local administration, and therefore may not be kept at the Service Bureau. Only for the execution of definite operations may the file be sent to the Service Bureau, and it has to be returned the moment the punching machines have finished working on it.

For the processing of alterations in the punched card file the town again requires the assistance of the Service Bureau. Therefore all requests for alterations are daily put on special forms and are sent, along with any punched cards that must be altered, to the Service Bureau. Thus because the municipalities do not have their own punched card machines, all the mechanical work is done by the Service Bureau, which is certainly a special form of service for Dutch local government.

If the regulations could be so changed that they would allow for storage of the punched card files at the Service Bureau, work could be carried out in a different and possibly more efficient way. Meanwhile, this concentration of data processing has made possible the use of integrated systems. At the national Service Bureau of which I am speaking, the extensive work being done for local government has led to the use of the IBM-system 1401. You will understand why it was necessary to use this system if I say that before every election there must be prepared within a short space of time — 15 working days to be exact — something like two million summons cards for all the people who have the right to vote in the municipalities covered by the Service Bureau, and also over 6,000 lists of these same inhabitants for the voting bureaus in these areas.

In general, the following is what the Service Bureau does for local government. First, it mechanically transfers data from the punched cards to outgoing notifications and announcements, to lists and other cards. It does, in fact, all the ordinary jobs that punching machines can do. This means that for the towns which use the facilities of the Service Bureau, it is no longer necessary to do the time-consuming copying jobs which were becoming more and more troublesome. Moreover, the municipalities now make use of the Service Bureau for elections, military service, lung tuberculosis check-ups, vaccinations, for the sending out of notifications to heads of households and any other special groups of the population, etc., etc.

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In the second place, it is now possible to make statistical surveys on a far wider scale. The increasing activities of the local government in such fields as the building of schools, care of old-age pensioners, urbanization, industrialization, social and sociological enquiries, etc., have created an increasing demand for data regarding housing, age-groups and other groups of the population. To a great extent these data can now be extracted from the population register with the aid of the punched card system, thereby increasing the significance and function of the population register. In addition, the rapid development of social and cultural ideas in the Netherlands — where people like to be thorough in such matters — has also made it necessary to obtain more details about the inhabitants of the various towns. Where the population register has been extended with a punched card register, much assistance can be given. It is an assistance which is also greatly appreciated by the churches.

In the Netherlands today, the Service Bureau has a function in local government which may be termed of public importance. And it may be stated that partly as a result of the use of information-processing systems such as, for instance, the punched card system, a structural change is taking place in the character of the local administration. As for costs, in general, one cannot say that the work which used to be done with such effort by the government itself can now be done more cheaply by the Service Bureau. Primarily, the town's officials are freed from the soul-destroying work of copying out all kinds of data and secondly, and this is an extremely important point, the range of possibilities for municipal administration has increased tremendously. It is difficult to make comparisons with the situation as it used to be, but in any case our experience has shown that the present way of working is faster and more accurate.

The introduction of the punched card system in Dutch local administration has also led to changes in the routine of the town clerk's office, for although those offices which make use of the Service Bureau do not themselves have punched card machines, the new system has compelled them to review the organization of their work by means of procedure analyses.

The constant increases in the salaries of local administration personnel and the increasing shortage in the Dutch labor market have naturally also influenced the decision of many municipalities to turn to the Service Bureau for extensive and complicated jobs. Generally speaking, local administration officials have not been sufficiently trained in making use of the modern technical methods of administration which the punched card system and other information-processing systems are bringing to their notice, and much might still be done in this field. We also find that the entrusting of certain work to the Service Bureau leads to an upgrading

in the type of work done by the local government official. The fact that so many time-consuming jobs can be taken over by the Service Bureau means that time is saved which can be spent on more important work, work more definitely connected with local government.

Finally, I should like to summarize a few important aspects of the service we offer for the Dutch local administration.

1. Our service is all-round, that is to say, it comprises:
   a. arrangement of the file,
   b. processing of alterations,
   c. research and programming of the work according to uniform systems,
   d. execution of the work,
   e. check-up on the completed job,
   f. delivery in the form most suited for the administration.

   This all-round service means, among other things, that a municipality which uses the facilities of the Service Bureau does not need to employ its own punched card operaters, systems analysts, programmers and other operators. These specialists are employed by the Service Bureau. Moreover, the Service Bureau delivers a finished product, that is to say, the results can be used immediately for the purpose required, without further administrative work.

2. The files are kept at the town clerk's office. This means that they frequently have to be sent to the Service Bureau for processing with the result that processing of population data with the aid of magnetic tapes, for instance, is at present impossible unless a way can be found for these tapes to be suitably stored at the town clerk's office However, at present it is impossible to completely fulfill the conditions for proper storage of tapes.

3. The Bureau's service has to come up to the highest standards of expert knowledge, speed, accuracy, reliability, willingness to help, being forward looking, and secrecy. This means that the Service Bureau must have a staff of specialists with expert knowledge of general and local regulations and procedures, and also with an advanced knowledge of the possibilities of the technical aids.

I hope I have been successful in giving you some idea of the way in which the use of mechanization and automation for the data processing in the field of population registration has developed in the Netherlands.

DISCUSSANT — **Robert E. Drury,** Chief of the Electronic Systems Division, U.S. Census Bureau, Washington, D.C.

Mr. Boer has described a very fine example of the application of mechanization and automation to reduce the demand on human resources for routine paper handling and data manipulation activities. In the United States we have no exact parallel for the process Mr. Boer has described. While we do have registration for election purposes, this is entirely under the control of local authorities, with no national government specifications as to the manner in which it is to be done and no use of the voter registration list for statistical or other information purposes. Our national census is assembled by means of interviews of all households in the United States, starting from the beginning each ten years, with no previous listing or registration of the population.

We do have in the United States, however, many applications of mechanization and automation which are similar to that described by Mr. Boer. Our social security system, for example, involves the assignment of account numbers to each of our employed persons when he first obtains employment; by now there are perhaps 130 million accounts in this system. Each three months all employers furnish reports of the amounts withheld from employees' salaries to provide for social security and these reports must be used to update the master accounts that are maintained for each employee. This is a massive operation and involves the use of high speed electronic computers around the clock, seven days a week. One of the things we find most troublesome in this sort of process, one of the things in which machines can serve a limited function, and one of the things which I think Mr. Boer has probably found in his work too, is that people don't spell their names the same way every time they list them. Moreover, people forget their social security numbers.

The problem of identifying these massive reports of all the wages withheld for all employed persons and matching them with the proper master record is tremendous and is at the heart of the difficulty encountered in this system. Our social security system involves primarily the maintenance of these employee records and the updating of them every quarter as new reports come in. One person may be employed by 10, 12 or 15 employers during a quarter. Therefore, many pieces must be brought together and carried to an individual's account. Identification is another separate operation. There is also the answering of inquiries of about 15,000 persons a day who want to know where their employee accounts stand and what their contributions have been to date; these 15,000 inquiries a day are answered in a 24 hour period. Moreover, as people approach retirement age they begin to file claims for benefits and the benefit computation is made by six different formulae. The employee is given the choice of the

formula which gives him the best benefits, in view of his particular circumstances. As you can imagine, there is a tremendous amount of calculation involved in this.

I would like to make a few general comments concerning the application of mechanical and electronic methods to data processing because, despite my introduction, I don't consider myself an expert in mechanization and automation of information processing, rather I think I am beginning student in the art of applying tools to new areas of man's activity. I would fully expect that technology and man's cleverness can bring about the same sort of revolution in the assembly, interpretation and use of information in records as the same combination has achieved in the manufacture of goods, in transportation, in communication and other areas of our life. Just as in these areas, the nature of the tools change the nature of the job way down to its roots, and the structure needed to do the job, the application of mechanization and automation, will require fundamental changes in our concepts and ways of doing administrative statistical work.

Perhaps the biggest and the most expensive error that is made over and over again in the attempted application of the electronic computer technology to office work is to regard this merely as a way of doing the same things faster, cheaper and more accurately. The outstanding contribution modern technology can make to administrative and information processes is to substitute human-designed and machine-applied logic and manipulation for individual human judgment and work in the vast areas of evaluation and decision-making on a routine level that characterize administration and information processing as we know it. In my experience, very little has been accomplished in holding a stop watch on a man at work and pushing him for more key strokes per minute, more claims audited per hour, more crank shaft machines per day. Instead, major gains and effectiveness and productivity of operations depend upon re-examination of concepts, wholesale combination and elimination of functions, realistic evaluation of steps really necessary to produce adequate results, sophistication and gradation of efforts in porportion to the significance of results from application of efforts.

When one starts to apply mechanization and automation to administrative and information handling activities, one must start from the beginning to re-examine and re-plan the entire sequence of activities affected. The machine devices that will be employed are still tools, of course, but tools of such radically different character that their proper use will bring about a final work sequence that is as different in content as the manufacture of shoes in a modern factory is from the hand cobbling of shoes in a home industry economy.

As you draw on modern technology to assist you in the effective performance of administrative functions in a modern world, you will find that the benefit you gain from a reorientation of your thinking and your approaches to the attainment of your objectives will rival, if not exceed, what you gain from the use of mechanical and electronic machines. In either case, what you gain will be in direct proportion to the amount of imaginative creative thinking you apply in planning your mechanized or automative activity. You also will find, to your sorrow, that no one but you and yours can do this thinking. Do not rely on some magic of automated processes to solve your problems. Machines can work for you only as well as you can lay out the task you want performed. This is not easier than laying out work for human performance; it's much harder. You will be well rewarded for your effort, but it won't be in peace of mind.

GENERAL DISCUSSION

Participants: R. Ramos, Brazil; N. Prichard, Great Britain; J. Pena, Argentina; J. Birckholtz, Germany; M. Soto, Argentina; L. Attilio, Italy; W. Murgatroyd, Great Britain; Dr. W. Kinzl, Austria; R. Perez, Argentina.

One of the primary considerations of a municipality in deciding whether or not to use automated equipment is the cost involved. Whether such equipment is rented or purchased municipalities may reduce the financial burden that ensues by cooperating in the use of the machines and thereby cooperating also in the expenditures involved. In London, for example, **Mr. N. Prichard** stated that six boroughs have established the Salvage London Computer Unit which has already appointed a skilled staff that is in the process of preparing programs. Work is now being done on the various payrolls and it is planned to add other programs as they are developed. Moreover, in order that the machines will be more efficiently used by not being idle during long periods of the day, Parliament has agreed that local authorities may have powers to sell time on their machines to other organizations.

Mr. Prichard also gave as an interesting sidelight the technique used by the London County Council to interest its employees in the new Electronic Recording and Integrating Computer it had purchased. This was done through a competition to name the machine, which has now become personalized to the employees following its christening as "Ernie". Through this technique any initial hostility to the machine has been largely overcome.

Whereas the cost involved in the use of automated equipment is an important factor in technically developed countries, it is even more so in those which are not. This is the situation in Argentina, for example, where

monthly rent and import licenses make it oftentimes prohibitive for the smaller and poorer municipalities to acquire and staff such equipment.

Mr. R. Perez stated that his city of San Martin has met this problem in much the same way as was suggested by **Mr. Prichard,** by providing services to other municipalities. Another factor offsetting the cost of the punched card machine is that through its use tax evasion has been greatly reduced and incoming revenue thereby increased. Not only would lower import fees encourage the use of automated equipment in less advanced countries, pointed out **Mr. Perez,** but so also would the training of local operators in the more advanced nations. Although Argentina now has a special school for this purpose, additional training is needed to obtain the full benefits that can be derived from the use of automated equipment.

As important a factor as cost in considering electronic machines is the use to which the machines would be put. The question was asked as to when, where and how electronic equipment can best be used. **Chairman Mitchell** answered by noting that this is a general problem faced by many countries. To help solve the problem the Municipal Finance Officers' Association of the United States and Canada has appointed a standing committee to investigate possible applications. It is the purpose of this committee to publish a booklet, as soon as possible, which will then be transmitted to all the 3,300 members of the organization advising them of the applications that some of the more successful data processing installations have already put onto machines, how much the equipment costs, where personnel were obtained and trained, what problems were encountered with bureaucrats within their organization, etc. This should be a useful booklet to interested persons and municipalities.

The use of electronic equipment raises another important problem: what machine can best do the work that must be done and in how far do different machines compete against one another? **Mr. L. Attilio** pointed out that whereas the speakers had made a distinction between computers and universal punched card machines, he believed that this did not represent a choice between computers on the one hand and punched card machines on the other. Rather, these are very different types of machines for different sorts of work that are not competitive, namely regular or universal accounting, which is carried out continuously, and periodic accounting, which is carried out during certain months. However, the difference between these two types of machines can disappear if accounting can be done with specific machines that can also do their normal work as well. Such machines can punch on paper tapes which can then be worked out by the typist.

The question was asked if local governments should make population register data available for private business, for mailing lists for adver-

tising, etc. and if so, what price should be charged for this service. **Mr. Drury** stated that this was a policy matter and not a technical question to which there is an accepted answer. In the Bureau of the Census a vast amount of information concerning persons, businesses and all areas of economic life is collected in strict confidence and cannot be made available for private use. However, statistical summaries can be made available for manufacturers seeking to locate plants in areas of proper labor supply, for example, and statistical summaries are also made available to other government agencies where this is not inconsistent with public policy. Public policy in this case is defined as the desire to make the same type of information available to everyone on the same basis. In addition, special tabulations of census results are furnished at the cost of producing the tabulations, again where public policy is not involved.

Although no specific answers could be given, two more questions were raised in regard to the use of electronic equipment by municipal governments. The first was: who should be responsible for the operation of the mechanized systems? In the Netherlands this is the responsibility of the Town Clerk, in some municipalities in England control is exercised by the City Treasurer, in some American cities data processing equipment is the responsibility of the City Auditor. At the present time, this question is being widely discussed, but there is no answer as to which is the best practice.

The second unanswered question concerned the training of technicians to repair machines that have broken down. **Dr. Kinzl** reported that in Vienna, where electronic computers are being widely used, certain machines have sometimes required lengthy repair work by an expert. In one instance it was essential that the repairs be done quickly in order that certain accounting work regarding the payment of monthly checks to retired people could be carried out. At that time it was fortunate that an expert could be found, but this might not be possible at another time. Therefore, the problem arises how municipalities can train repair workers who will always be available to them.

Professor Salvatore Rebecchini, Former Mayor of Rome, served as seminar reporter.

CASE STUDY: MECHANIZATION AND AUTOMATION OF FISCAL AND REVENUE ADMINISTRATION IN THE DISTRICT OF COLUMBIA

by

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Organization and Program Responsibilities

The district of Columbia is a city of some 760,000 people, lying in the heart of a metropolitan area of some 2 million people. The District of Columbia Government, a municipal corporation headed by a three-man Board of Commissioners, serves not only the city residents, but also the hundreds of thousands of people who come into the city daily from the metropolitan environs to either work, shop, or transact business. The city government, which is organized generally along functional lines, employs some 26,000 individuals and requires an annual budget of approximately $ 250 million.

In the District Government, the Finance Office is the agency which performs the financial management functions of tax administration and fiscal accounting which shall be discussed in this case study. Within the Finance Office, the Processing Division operates a sizable punched card installation on a two-shift basis at an annual equipment rental cost of approximately $ 105,000. This installation includes an electronic calculator, four accounting machines, various sorters, collators, reproducers, interpreters, and twelve key punch and seven key verifier machines. The Division employs 83 people, of whom 45 are directly involved in machine processing.

In connection with the tax and fiscal accounting functions of the District Government, the Finance Office, through its mechanized punched card operations, must process some 270,000 individual income tax returns annually, 80,000 employers' quarterly reports of income tax withholding from employees' salaries, 30,000 declaration returns of estimated income tax and 90,000 quarterly installment payments, 18,000 business franchise tax returns annually, 12,000 sales tax returns monthly, and maintain some 30,000 accounts receivable for these and other taxes. In addition, the official assessment roll of the District of Columbia, contain-

ing 162,000 properties, is mechanically prepared. Property owners are billed and real estate payments are recorded on punched cards.

Mechanical operations required to perform the daily detail accounting and produce the necessary financial reports incidental to controlling the funds appropriated and expended by the District of Columbia Government involves the processing of approximately 350,000 accounting transactions annually. Furthermore, complex mechanized payroll operations are performed in order to pay our 26,000 Government employees, through five separate and distinct salary systems. Upwards of one million punched card checks are printed each year for payment of salaries and goods and services received.

We believe that the District Government's tax and fiscal operations are more mechanized, integrated and varied than similar operations in most other local governments. The District of Columbia stands today upon the threshold of the application of electronic data processing to its revenue and fiscal programs.

Since 1956 when mechanized tax, accounting and payroll operations were first centralized in a newly established Processing Division, program responsibilities and related workloads have been increasing at a rapid pace. An orderly pattern has been followed of increased mechanization of tax and fiscal programs with an updating of equipment as the needs demand. But let us now trace the growth of tax and fiscal responsibilities in the District Government and the increasing mechanization which has necessarily followed. To gain a proper perspective, we first need to examine some of the external and internal causal factors which have led to the expansion of the revenue and fiscal responsibilities.

Factors Affecting Program Responsibility

Among the external factors have been the following:

1. **Population growth.** In 1940 the population of the District of Columbia was 663,000. The population of the entire metropolitan area was 967,000. In 1960 the population within the District had risen to approximately 764,000, but that of the metropolitan area rose to 2,000,000. Both the city and the metropolitan area are now among the ten largest in the United States. Not only the city residents, but the bulk of the population of the surrounding suburbs work or shop in the city, placing such demands on city services as improved highway facilities, increased police and fire protection, better traffic flow and enforcement, etc.

2. **Changing concept of government responsibility.** New and increased government programs and services are expected and demanded by our

citizens today. As an example, various types of welfare services and public assistance to the needy of the community are now considered a necessary function of government. Informational service demands on the government have increased because the complexities and economics of business require fast access to information. For instance, the D.C. Finance Office's assessment records unit has experienced increased requests over the years for prompt information on the descriptive, financial and legal status of real properties.

3. **Rising costs.** The government's revenue and fiscal program have been affected by the general economic environment in which it exists. Governments, like individuals, have experienced an era of rising costs for goods and services. This situation has imposed on government administrators the need to more effectively manage their funds and to be able to promptly and accurately appraise at all times their financial situation. The impact of this situation has been the need to obtain more meaningful and prompt financial reports.

Internal factors have also had an effect on revenue and fiscal administration. The trend to bigger government, caused by some of the external factors mentioned, has created a need for scientific management and the application of better techniques for administering programs.

For example, in the District the pay-as-you-go method of income taxation simplified the collection process but at the same time opened a whole new area for tax compliance activities. A desirable objective would be to match all statements of wages withheld, furnished by the taxpayer on his return, with corresponding copies of statements of wages withheld furnished by employers annually. This would enable the District to discover inaccuracies both in taxpayers' and employers' returns and would identify non-filers in both instances. One hundred percent coverage in this type of compliance effort is impractical with manual methods when dealing with several hundred thousand taxpayers, but with advanced automatic data processing equipment this type of large-scale compliance effort becomes possible.

Similarly, in the real estate tax area, there is a need for continuing review and appraisal of real properties in order to assure equalization of the tax burden among property owners. One method of providing this is through assessment-sales ratio studies which determine the level of assessed value of properties in relation to current market value for those properties which are sold. To perform these studies manually is a time consuming job. The number of sales and the burdensome aspect of real estate taxation combine to demand faster methods of making these assessment-sales ratio studies. Tax administrators look increasingly

toward modern data processing methods to promptly furnish the data needed with a minimum of effort.

Another development in local government that is having an impact on the tax administrator is the city's involvement in urban renewal activities. Such activities require detailed information on the location, description and value of property in order to make the proper urban renewal decisions. In most cities, real estate tax records are the basic source of such information. Therefore, it has now become desirable for the tax administrator to expand his record keeping to provide information that is needed not only in administering the real estate tax but is needed also to properly perform other governmental functions.

Increases in Program Workloads and Mechanization

With this background let us summarize the impact on the District Government in the last 21 years of these changes in revenue and fiscal responsibilities. Before 1939 the only major tax levied in the District was the real estate tax. In that year the basic income tax law was passed. Since then other taxes have been enacted and a gradual and persistent increase in mechanization of tax and fiscal operations has occurred.

In 1940 the District of Columbia contained approximately 149,000 individual properties. Assessment and tax billing information was processed by manual keyboard posting to multi-copy forms. Some 80,000 income tax returns filed that year were clerically processed manually.

Also, in 1940 a budget of approximately $ 50 million was appropriated for the District to conduct its affairs. Allotment ledgers were maintained centrally on bookkeeping machines for all operating District departments and agencies. All other financial reports were prepared manually by the separate departments and agencies. The District Government paid 14,000 employees and 1,800 retirees in 1940. The payroll process at that time required four different kinds of deductions from gross pay; namely, retirement, subsistence and quarters allowances (for certain institutional employees), fines levied against salaries, and extra deductions for additional retirement purchased by some public school personnel. Payroll preparation was partly decentralized and for the most part manual, except for some large payrolls which were prepared on adressograph equipment. Some employees were paid in cash and others by check.

In 1941 bookkeeping machines were installed to record and perform accounting in connection with real estate assessments, tax billing and payment information.

In 1949 a sales and use tax law was passed requiring the registration of taxpayers, the mailing of returns and notices, and the receipt and clerical processing of some 12,000 tax returns monthly. To perform this tax workload in the most efficient manner, a small punched card installation was established, representing the first punched mechanization of a revenue program in the District.

In 1950 some 18,000 employees were on the payroll and there were 2,400 retirees. In addition to the payroll deductions already being made, an additional deduction for withholding of wages for federal income tax purposes was required. Conversion of payroll operations to punched card processing was begun in this year, in a separate installation, with a view to centralization of all payroll accounting and the payment of all employees by check.

By 1953 the budgeted funds necessary to operate the programs and services of the District Government had grown to $ 149 million, reflecting expansion in program requirements and services. As a corollary, the use of improved financial management techniques became essential to effectively administer a budget this size. Accordingly, punched card systems were initiated to centrally prepare monthly allotment ledgers and periodic unliquidated obligation statements for departments and agencies. Also, in that year a start was made toward the central preparation on punched cards of monthly object class accounting reports for departments and agencies.

The Revenue Act of 1956 broadened the individual income tax base, established withholding of wages at the source for D.C. income tax purposes by employers, and also required certain categories of taxpayers to file estimates of their income tax in advance and make quarterly installment payments. The impact of these substantial changes in the income tax law was first felt operationally in 1957. There was a tremendous increase in workload. Individual income tax returns filed annually increased from 80,000 to 250,000. Approximately 80,000 employers' quarterly reports of wages withheld were filed that year. Some 30,000 declarations of estimated tax were received and these declaration taxpayers are billed and required to pay their estimated tax quarterly in advance. These changes in the law increased substantially the complexities of income tax processing, audit and compliance activities.

Because of ever increasing tax and fiscal workloads, culminating in the large volumes created by the new income tax law, mechanical and clerical operations were consolidated, in 1956, in a newly created Processing Division of the Finance Office. The Division was created by combining the punched card installation utilized for sales tax proces-

sing with another separate punched card installation performing accounting and payroll operations. To this combination was added the necessary additional equipment and personnel to absorb the workload created by the 1956 revisions in the income tax law. Studies conducted regarding methods for administering the tax law revealed that continued manual handling of this increased tax workload would have required several times the personnel as were necessary under a mechanized system, and at a prohibitive cost. Thus, the Processing Division was created in the interests of economy and efficiency.

In view of the complex responsibilities imposed on the District Government by this time one might well ask why further automation through electronic data processing was not initiated in 1956. Analysis of the feasibility of proceeding directly to electronics was made and it was decided to defer taking this "giant step" at that time. There were two main reasons for this decision. (1) The only computers then on the market were large-scale computers requiring expensive rental and site installation costs. The workload and program complexities in the then existing tax and fiscal programs, although considerable, did not warrant the use of such expensive, large-capacity, computers. (2) There was a lack of the technically trained personnel and sufficient operating experience which is necessary for successful conversion from mechanical processing to electronic data processing. Furthermore, revisions in organization and staffing patterns, and over-all improvements in administrative procedures within the Finance Office were deemed necessary prerequisites to electronic data processing. Primarily for these reasons, it was determined that the best course of action would be a "walk before run" approach, in which we would continue to follow an orderly plan of updating mechanical equipment as the demands imposed by growths in program workloads and complexities required.

By 1957, the number of real estate parcels in the District of Columbia to be assessed and billed twice a year had grown to 162,000. With centralized responsibility for mechanization of tax programs established and equipment time available, punched card operations for real property tax billing and accounting were initiated in 1957.

In 1960 the number of income tax returns had increased to some 270,000 annually. Other workloads in connection with this tax also increased. But more important, the desire for increased effectiveness in conducting audit and compliance activities relating to this and other taxes, combined with the need for increased processing speeds in tax accounting, billing and refunding of overpayments, led to the determination that a medium-scale computer was the next step forward for revenue administration in the District. At the same time further growth also had occurred in the accounting and payroll programs.

By 1960 District budget appropriations had grown to approximately $ 240 million. The Processing Division was engaged in processing annually some 350,000 general ledger and allotment ledger transactions incidental to administering a budget of this size. Financial reports increased to include (1) reports of obligations and expenditures, (2) performance reports against established financial work plans, (3) periodic accrual reports in line with accrual accounting systems developed for operating departments, and (4) reports of capital outlay funds. Furthermore, by 1960 the District Government payroll had grown to 25,000 employees and 3,500 retirees. Nine deductions from pay were now required as part of payroll processing. Additional deductions and related statistical reports were now made for District of Columbia tax withheld, purchase of government bonds, federal life insurance and federal health insurance plans. It also became evident that further automation of these fiscal operations was the only logical answer to absorbing the complex and growing workloads.

Plans for Electronic Data Processing

Therefore, early in 1960, as a result of increasing program responsibilities, experience gained through centralized mechanical processing since 1956, and developments in the computer industry between 1956 and 1960, the decision was made to proceed to electronic data processing. An analysis was made of available equipment in terms of the needs of our operations, and it was decided to install an IBM 1401 data processing system in the Processing Division of the Finance Office late in 1961. The main reasons for this decision were:

1. Increased workloads and complexities of operations demanded it for the efficient administration of revenue and fiscal programs. Further increase in conventional punched card equipment to meet increasing workload requirements would have provided less practical and efficient operations than would the installation of a medium-scale computer. Furthermore, it was anticipated that the establishment of computer programs would provide eventual economies in operations through improved and more efficient procedures throughout the Finance Office.

2. Revenue and fiscal program requirements could not await the outcome of feasibility studies pertaining to the centralized use of a large-scale computer for increased automation of tax, fiscal and other government functions, such as health, welfare and engineering. A new line of medium-scale, modular and expandable computers with

low installation and rental costs permitted the conversion to electronics at no over-all increase in existing budgetary costs for carrying out revenue and fiscal programs.

3. Experience in conducting the centralized mechanized operations of the Processing Division since its inception in 1956 gave us the technical and management education and background which is a necessary prerequisite to proceeding into further automation through electronics. Both those of us in technical operations, as well as the administrators who used the results of our mechanized operations, are now more "psychologically prepared" for further advances in automated activities.

In line with this decision a "Pre-installation Project" was initiated in July 1960. A project schedule was established to provide sufficient lead time to complete the management planning, systems analysis and computer programming necessary by the equipment installation date of December 1, 1961. Our first task was to recruit a staff from within our own organization with the capabilities of performing the task ahead. We gave interested employees programming aptitude tests, examined personnel records and interviewed employees who appeared to have potential capabilities for performing this type of work. A staff of eight from among our regular employees was selected and one experienced programmer was hired to provide technical guidance to this group. The staff consisted of punched card technicians, computer programming trainees and employees with general tax and fiscal administrative experience. This staff was divided into teams and each team was assigned a tax or fiscal program which was to be converted from a punched card to an electronic system. The "team captain" was the "subject specialist" with management experience in the conduct of the tax or fiscal program to be converted. For example, one team was responsible for developing a system for real estate tax billing and accounting. The head of this team was the supervisor of the section which maintains assessment records and property tax accounting controls. The head of the "payroll team" was a professional accountant. Each team also included the "technicians" who would eventually develop the detailed computer operations.

Each team was required to conduct their studies along the same lines:

1. Audit existing punched card and related operations and procedures.

2. Analyze the data gathered to identify problem areas and areas for improvement.

3. Develop a general computer system.

4. Prepare reports to management outlining the basic operating system and containing related management recommendations.

5. Based on an approval of the report, develop the actual computer runs, routines and forms.

At the point where the basic computer system was approved by management the tax or fiscal program specialist was relieved from his assignment on the project. The technician then proceeded to develop the technical computer routines and instructions within the framework of the general system proposal. However, by having these two individuals work jointly on the project from the beginning a mutual benefit resulted. The program specialist gained insight into the capabilities of electronic equipment and its potential benefits to him as a tax or fiscal administrator. The technician gained insight into the needs and the particular requirements of the program administrator. Together, they were able to identify and develop improvements in program operations.

The EDP Pre-installation Project and resultant computer operations are expected to produce four main benefits to mangement:

1. Improved efficiency of operations through increased mechanization and a reduction in manual clerical handling. An example of this benefit is apparent in the payroll program where manual controls will be greatly reduced. Certain operations now performed manually, such as preparation of change slips notifying employees of changes in pay status, will be prepared as a by-product of computer payroll accounting operations.

2. Mechanization of operations presently not mechanized. For example, a machine verification of taxpayer computations on business income tax returns will be performed. At the present time, such verification is performed by clerks.

3. More meaningful information will be available to management to assist in administering tax programs. As an example, total monthly sales tax account information will be accumulated and produced in a single consolidated report. More complete data on gross and exempt sales by classes of business will be furnished. Analysis of this data by the sales tax administrator will eventually provide the basis for developing audit norms by business class which ultimately can be made an integral part of sales tax processing operations.

4. Greater processing speeds will be possible which will permit the meeting of deadlines promptly and more efficiently. For example, in connection with real estate taxes we must update assessments, reconcile accounts, and print and issue some 153,000 tax bills twice a year. Extensive machine time is required under present mechanical methods. With the computer the processing time required to do this job will be less than half that presently required.

Impact of Mechanization and Automation

Our experience in the District Government in applying automatic data processing methods to revenue and fiscal administration has shown that mechanization and automation has impact on two broad aspects of administrative management — organization and function, and personnel. The establishment of fairly sizable automatic data processing installations may need to be accompanied by other organizational realignment and shifts in functional responsibility. For example, within a revenue department it may be more economical and practical to combine several smaller punched card installations into one. To do this could result in better utilization of equipment and would require less personnel to operate than would be necessary if several smaller installations existed. However, the smaller installations would probably be directly under the program manager, since the equipment would be serving several administrators. Although over-all administrative responsibility might still be assigned to the tax program manager, some control might be lost over the total performance of his program, since some of the activities and operations involved in administering the functions would now be performed by the data processing manager. On the other hand, the mechanical processing of volume clerical workloads in a unit specifically organized for that purpose should free the tax administrator to devote his energies to the more professional aspects of his functional responsibilities, such as tax auditing and enforcement.

This is exactly what happened in the D.C. Finance Office in 1956. Small punched card installations were removed from the individual control of the sales tax administrator and the accounting officer and were consolidated into a data processing division. Also, at this time, rather than install punched card equipment under the income and franchise tax administrator, equipment was added to the new Processing Division to handle new income tax workloads. This consolidation of data processing activities also had impact on higher levels in the organizational hierarchy of the Finance Office. Before the establishment of the Processing Division the Finance Office was organized solely by function. Now it is organized by "process" and by "function". Therefore, part of the Finance Officer's present administrative responsibility is the coordination of those aspects of tax and fiscal programs which are performed by the "process" division with other aspects of these programs performed by the respective tax and fiscal divisions.

Automation also has impact on operating, technical and managerial-type personnel. It creates the need for new types of jobs and new talents and makes other jobs obsolete. It is possible to handle displacement of personnel with a minimum of upheaval if this impact is thought through

and phased-out well enough in advance. Clerks and operating supervisors may need re-training in order to either (1) obtain new skills and qualify for new jobs, or (2) perform their existing jobs better by learning how to work with the output the equipment produces.

At the managerial level, the growth and technical development of A.D.P. installations have created a new type of administrator — the "data processing manager." Since he deals essentially with men and machines on a production basis, he must be schooled in the techniques of scientific management. He must know equipment capabilities and how to efficiently utilize the equipment to obtain the best results. He must think in terms of scheduling, performance standards, economy of operations, production control and quality of input and output. The data processing manager must be cognizant at all times of the fact that he is running a service organization and that his main purpose is to serve the functional managers; in our case, the tax and fiscal administrators. Top management must also train and adjust itself to live with automation. The "tax commissioner" or the "comptroller" must be familiar enough with automatic data processing to know what it can do for him and what impact automated operations will have on his role as an administrator.

Based on our own experience, we cannot overemphasize the importance of adequate administrative pre-planning including thorough systems and procedures studies. Answers to the questions of how and when operations should be automated depend on studies which will (1) determine the state of management preparedness for conversion to automatic data processing; (2) determine personnel capabilities and needs; (3) identify operational benefits which may result from automation; and (4) analyze specific equipment requirements. Even if you decide against automation, the results of your systems studies will be well worth the cost and effort.

Status and Future of Automation

In most of the District of Columbia Government automation is in its infancy or in varying stages of development. Some agencies are using or comtemplating punched card equipment, while others are thinking of taking the direct step from manual to electronic data processing. Planning studies relative to the role of computers in many functional areas are just getting started. However, with the rapid advances being made in data processing equipment and skills today, there seems to be no doubt that mechanization and automation of operations throughout the District of Columbia generally will increase at a faster pace than has occured in the past.

In connection with revenue and fiscal administration, automation has progressed to the point where a relatively small card computer has been ordered and actual programs are being written and tested. In approximately five years we have proceeded from centralized punched card processing to the first electronic data processing installation in the District Government. In this time we have had many planning, management and operational problems and we expect there will be more when the computer arrives. Nevertheless, the increased management and technical knowledge gained as we plan for our first computer have given us confidence in our ability to successfully use this new tool. We look forward to making even greater contributions to the administration of revenue and fiscal programs through the use of larger, more flexible equipment, perhaps utilizing tapes and random access storage, in the not-too-distant future.

DISCUSSANT — **Andrew Holstrom,** Consultant, Norton Co., Worcester, Massachusetts.

Mr. Sharlip has been talking about the District of Columbia. I come from a community of about the same area — 37 square miles. However, we have a population of 200,000 as opposed to the District's 760,000; we have 5,500 municipal employees against the District's 26,000; and our budget is $ 42 million, while that of the District is $ 250 million. Nevertheless, we do have certain things in common, with reference to local government administration, among which is the great increase of governmental functions and the consequent movement in the direction of using electronic equipment. In this connection I have one word of warning — that we do not make our terms so complex, especially when talking with lay people, that the whole subject is completely confused. Rather should we point out that the electronic process is not simple but that the results obtained are done so more rapidly and efficiently.

Mr. Sharlip mentioned in his paper that the District of Columbia collects real estate taxes twice a year. I think they would save themselves a great deal of trouble if they collected them only once a year. In Massachusetts, to use an example along these lines, drivers' licenses are issued for a two-year period and license plates are also valid for the same length of time. The point is that economy is a very important factor and we should be careful that we do not become so enthusiastic about using our new equipment that we process everything. We do not want to find ourselves in the position where we're using more people than we used before, in spite of the fact that we have introduced automation.

Finally, if this whole story of the mastery of machines over muscles overwhelms you, just remember that at heart we're still a simple kind of folk. It's a rather quieting thought to realize that, with all our technological processes, there is still no way of measuring a snowfall except by sticking a ruler down through the snow.

GENERAL DISCUSSION

The only participant in the general discussion period was **Dr. Vu-Quoc-Thong,** Rector of the National Institute of Administration, Republic of Vietnam, who spoke on the introduction of mechanization in a developing country with no previous experience in this matter.

The use of mechanization in the Bureau of the Budget of the Republic of Vietnam was first studied in 1957 because, despite capable personnel, the government did not have the proper means of controlling its

own expenditures, due to the lack of coordinated budget accounts and internally unclassified expenditures. At this time only the Treasury and the National Bank were informed about mechanized accounting operations, but it was decided to apply these operations to the control of the national budget. As a result of the study performed at this time new control measures were instituted and a punched card system was installed and operated by the already existing staff.

The introduction of the punched card machine in the Treasury Department and its Bureau of the Budget gave rise to a functional control over the budget and a day-by-day knowledge of the financial situation. It gave rise to permanent statistics and the establishment of a proper budget policy. Moreover, during this first experience in the mechanization of fiscal activities it was possible to gather all kinds of information that it had not been previously possible to gather and the punched card system could thus be properly used.

As the result of their experience, the Vietnamese have reached the following conclusions: first, to introduce mechanization and automation into government administration it is necessary that this decision be completely supported by all the governmental agencies. It is also indispensible that the initiative for and the coordination of operations and projects be centralized at the very highest level, namely within the Bureau of the Budget, and directly under the supervision of the head of the government. This is necessary becomes sometimes the new process means doing away with old fashioned administrative routines and the responsible body must thus have sufficient capital and authority to see that its decisions are implemented.

There were, of course, certain obstacles that had to be overcome in introducing mechanized operations in the Republic of Vietnam. The first was the low salaries of the personnel, which was met by training small teams of competent workers to handle the equipment. Furthermore, administrative personnel were given a period of training in the use and management of the machines which also provided the opportunity of stressing, in addition, better supervisory and administrative methods. The second obstacle was the psychological resistance of the personnel to the machines. This was met by showing that not only could a rational method be developed for the already existing work, but that supplementary work could be carried out as well, for the machines are capable of doing certain operations that personnel cannot. As for the fear of losing their jobs, personnel in the Bureau of the Budget have experienced that the total number of staff has risen from 150 to nearly 300 persons to take care of the additional work that is now being done.

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The above are some of the obstacles that were met in introducing mechanized operations into the government of a developing country. Whereas in a developed country, where administration is well established, it is often difficult to introduce new methods and techniques without the establishment of some sort of special commission, in a country in the throes of development, automation and mechanization will often find a propitious terrain, for here they are considered a means of proper progress, as the experience in Vietnam is a proof thereof.

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