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# Computers and Local Government: Low Cost Information Processing Technologies and Strategies for Local Governments: A Handbook for Workshop Participants

Center for Public Affairs Research (CPAR)
*University of Nebraska at Omaha*

# COMPUTERS AND LOCAL GOVERNMENT

## A Handbook for Workshop Participants


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# COMPUTERS AND LOCAL GOVERNMENT:

Low Cost Information Processing
Technologies and Strategies for
Local Governments

## A Handbook for Workshop Participants



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# FOREWORD

This training program was developed as part of a Department of Health, Education, and Welfare (HEW) grant, under the Higher Education Act of 1965, Title I-A, Community Service and Continuin Education, as amended, to the University of Georgia, Institute of Government (IG) and Institute of Community and Area Development (ICAD), in partnership with the International City Management Association (ICMA).

Using the extensive experience and knowledge of IG, ICAD, ICMA, and others, this training program and its supportive materials, with emphasis on the use of low-cost computer technolo as a management tool, respond to the needs of small local governm management throughout the nation.

Credit for this publication is due to many, especially all of the local government officials who participated in the pilot workshops around the nation and who, through their candid evaluat comments, and suggestions, determined the contents of this traini program.

The editor of this training program was Mr. John Scoggins, Institute of Government Data Processing Associate, joint-staffed with ICAD, who served as Project Coordinator for the thirty-month HEW project. Others who made major contributions to this publica Mr. James Elkins, Project Director; Mr. Robert Sellers; Mr. Jerry Murtagh of the University of Georgia; and Mr. Martin Anochie and Mr. Harlan Smolin of ICMA--provided invaluable information, guidar and assistance in the development, testing, and evaluation of the materials contained in this training program.

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A. WORKSHOP CONTENT

These workshop presentations will focus on what the local government manager or official ought to know about the implementation and utilization of information systems technology. Two basic assumptions underline this presentation:

1. Information is an essential and costly resource which must be managed effectively if the local government is to achieve its objectives.
2. Managers, department heads, and elected officials have an important, indeed crucial, role to play in the design, selection, management, and evaluation of the information systems technology which is adopted by the local government.

B. AVAILABLE OPTIONS

There are two options available to managers and officials for meeting the challenge presented by computers and data technology:

1. Let the character of the technology determine the nature of change in the local government organization. This approach is best characterized by a "The computer requires it!" mentality.
2. Direct the use of computers and information systems technology to fit the purposes and

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requirements of public administration and public policy.

Exercising the latter option will, of course, require public managers to take an expanded role and assume direct responsibility for managing and controlling the development of data processing technology so that it serves the operating and decisionmaking needs of their local governments.

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A. HOW YOU VIEW THE COMPUTER WILL DETERMINE HOW YOU USE IT IN GOVERNMENT.

1. MACROPERSPECTIVES

a) TECHNOLOGY IS AN EXTENSION OF HUMAN BEINGS.

Example: The telephone and the automobile permit people to extend themselves beyond their immediate surroundings.

b) INFORMATIONAL NETWORKS COMPOSE THE WIRED-NATION SYSTEM.

Example: People and companies in your municipality will be able to use community computers directly to pay taxes, receive copies of documents, and locate and reserve services.

c) TECHNOLOGY IS A CHANGE AGENT IN POSTINDUSTRIAL ECONOMICS.

Example: Automation permits new services for citizens and new roles for municipal professionals.

The computer is a personal tool to permit municipal employees to be more productive and more effective. Other personal tools are typewriters, telephones, calculators, and copy machines.

2. MICROPERSPECTIVES

a) THE COMPUTER IS A HIGH-SPEED CALCULATOR:

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Example: The computer calculates and prints tax bills in a very brief period of time, thus relieving employees of time-consuming, repetitive tasks. This is important for productivity in serving the public.

b) THE COMPUTER IS AN ANALYTICAL MACHINE.

Example: Analyzing data for statistical and management purposes, such as geocoding systems for improved analysis of disparate sets of data and data banks.

c) THE COMPUTER IS A GENERAL PURPOSE SYMBOL MANIPULATOR.

Example: The Integrated Municipal Information System (IMIS) is set up to integrate municipal processes through manipulation of data symbols.

B. HOW YOU USE COMPUTERS IS RELATED TO PAYOFFS

1. PAYOFFS ARE CONSIDERED TO BE:

a) PRODUCTIVITY (efficiency/economy)

b) EFFECTIVENESS (better decisions, improved mission achievement)

c) IMPROVED SERVICE DELIVERY

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2. The relationship among uses, views, and payoffs can be illustrated in the following example:

PROPERTY DATA

| Uses | Views | Payoffs |
|---|---|---|
| Print tax bills and accounts receivable | Calculator/ Printer | Productivity |
| Land development plans and decisions | Analytical machine | Better decisions |
| Pay taxes from home, receive sales analysis in local realtor's office | Wired nation | Improved service delivery |

C. USE OF COMPUTERS SETS UP A SYMBIOTIC-LIKE RELATIONSHIP

In biology, symbiosis refers to the close union of two dissimilar organisms. This type of direct relationship can be applied to the interactions between men and machines.

Examples: We have a direct relationship with a telephone. We communicate directly with the other party by voice. We do not take our message to a telephone center for transmission by voice to another office for translation onto paper to be carried to the party to whom we want to talk. We have a direct and interactive relationship with the computer, a more dynamic technology. We "program" (instruct) the computer to anticipate

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problems, that is, to notify us when predetermined conditions have not been met, e.g., projects behind schedule or accounts overspent.

D. WHO'S IN CHARGE OF COMPUTER USE--MANAGEMENT, USERS, TECHNOLOGISTS?

1. Traditionally, the technologists dominate computer use in government.
2. Recently, management has begun to dominate and take command.
3. In the ideal model --

   MANAGEMENT--sets objectives and goals,

   USERS--(citizens and municipal employees)--designate use,

   TECHNOLOGISTS--develop standards and provide systems support.

E. ORGANIZATION ENVIRONMENT

The organizational environment is the key to effective management of computer use in government. Of course, a good environment requires a balancing of several factors.

1. POINTS OF VIEW

   Both executive and functional management points of view are necessary.

   a) Executive management focuses on strategic planning (e.g., goals, objectives, programs, missions, resource allocation).

      Executive management includes council, commis-

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sioners, mayors, selectmen, city/county managers, and top department heads.

b) Functional management focuses on management control (e.g., source utilization, monitoring progress of work, measuring and evaluating work projects).

Functional management includes department heads and their assistants, unit heads, top professionals, and supervisors.

2. INVOLVEMENT

Both users and technologists must be involved. See D-3 above.

Both citizen users and city/county employee users must be involved.

a) In time, other technologies, such as cable TV, will permit citizens and businesses in communities to use the municipal computer.

Examples: Lawyers can get copies of property deeds, and citizens can register for recreation classes or pay taxes directly from home.

b) Employee users should focus on how to utilize computers to improve services.

Examples: Employees can use computer terminal data to answer telephone calls or monitor individualized social service packages.

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3. PARTICIPATION

Both the management and behavioral sciences must participate to create the necessary environment.

a) Management sciences can provide knowledge and experience in the use of management analysis, systems analysis, and computer and telecommunications technologies.

b) Behavioral sciences can provide knowledge and continuous application of organizational development and interpersonal communication skills.

c) A balanced, integrated approach by both is necessary.

THE INFORMATION PYRAMID

1. The information pyramid includes all the component components for a complete system.

a) INFORMATION REQUIREMENTS: the broad information base needed for management, operations, planning, and policy decisions.

b) DATA NEEDS AND FLOWS: specific data items needed for information requirements above and the paths they follow through the municipal organization.

c) DATA MANAGEMENT SOFTWARE: a computer program that focuses on manipulation, organization, control, and display of data elements.

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d) INPUT/OUTPUT ACCESS ROUTINES: small computer programs that control the format and flow of data into and out of the computer.

e) OPERATING SYSTEM: a "master" program that controls the total operation of a computer provided by the vendor.

f) COMPUTER HARDWARE: the actual computer machine components.

2. Traditionally, cities and counties have used a bottom-up approach which focused on computer hardware, that is, beginning with f) above and working backward to a) above.

3. Currently, city and county management are stressing a top-down approach which focuses on information management, that is, beginning with a) above and working forward to f) above.

G. GOOD ORGANIZATION AND PLANNING

Both an application approach and a general-tool approach to computers must be taken into consideration for good organization and planning.

1. Application approach means that you develop a comprehensive plan of all the specific, detailed uses (applications) of computers for your organization. After setting priorities for these uses, you begin to implement them in sequence, one at a time, over a period of several years.

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2. General-tool approach means that use depends on the purpose or application in a random manner--only as the need arises. A telephone, for example, is a general purpose tool.

ANALYSIS OF NEEDS

Now that you have the big picture of the relationship among management, managers, and computers, let us take a look at why you or your organization wants (needs) a computer system.

1. WHY DO YOU WANT A COMPUTER?

   a) PRODUCTIVITY: There is no question that computers can make your organization more productive. Three kinds of computer-oriented productivity are possible:

      (1) cost saving

      (2) cost displacement

      (3) cost avoidance

      Cost avoidance is the most likely benefit to result from your local government's computer use.

   b) EFFECTIVENESS: While computers can help you do what you are now doing better, faster, and cheaper, their real potential is to do what you could not have done previously. For example, it would be impossible for the IRS to use human beings to match an employee's W-2 form, submitted with his/her income tax return, with

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the employer's copy. Imagine how much higher the federal budget would have to go if humans were to replace computers for this IRS task. Also think of the costs to have personnel ready to check on stolen car data within a matter of seconds -- which is the time frame of a patrolman in chase.

c) NECESSITY: Eventually, in our complex industrialized society, computers will become a no-choice decision. . .much like telephones. Much as local government employees find telephones a nuisance, they have become a necessity of life -- at least in the United States of the pre-21st century.

2. IS YOUR ORGANIZATION READY FOR A COMPUTER?

Once you have worked out the answer to, "Why should I consider a computer?" your next hurdle is, "How do I get my organization ready?" There are three general rules:

a) GET INVOLVED: Get involved in computer use in your local government and get your top management staff involved also. It is not a responsibility that you should turn over to technicians if you want to get the best possible possible use of the computer technology.

b) BECOME ORGANIZED: This means setting up a means for --

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(1) setting policy,

(2) developing plans,

(3) implementing plans,

(4) controlling results.

c) BECOME KNOWLEDGEABLE: The key to effective computer use in local government is blending knowledge of local government operations and management with knowledge of the technology. You have the former; people with the latter can be hired or brought in by a computer manufacturer.

THE PROBLEM: How can both communicate with each other? You and your top staff need to know about computers; computer technicians need to know about local government. It is important that a process be initiated keeping both education thrusts in mind.

3. WHAT ARE THE POLITICAL IMPLICATIONS?

We do not need to remind you that all governments -- local in particular -- operate in a fishbowl. Everything you will do with computers will be watched by "experts" in the community -- with little tolerance for mistakes. In using technology, anything can go wrong. You might want to buffer this potential

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problem by creating a citizens' advisory group of community people knowledgeable about computers.

THE PROBLEM: Each "expert" might push his/her pet approach. In most cases, you will not have any problem but be prepared for the worst possibility.

4. WHAT IS THE IMPACT OF GOVERNMENT COMPUTERS?

There are two ways of viewing computer impact: impact areas and types of impact.

a) IMPACT AREAS

The computer in your government will ultimately impact:

(1) Government employees -- by introducing ways of operating

(2) Government administrators -- by necessitating new ways of managing

b) TYPES OF IMPACT

Four types of impact will result:

(1) By improving efficiency and productivity, you can effect immediate cost displacement and/or long-range cost avoidance.

(2) By increasing effectiveness, you can provide better new services, reduce expenditures, create new roles and tools for your employees, and improve policy processes.

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(3) By improving management techniques, you can establish new forms of organization and a better control system.

(4) By setting up more responsive governmental organizations, you can improve the quality of life in your community.

Your responsibility is to consider all input areas and all types of impact as you study the initial and eventual impact of computers in your government.

5. WHAT ARE SOME OF THE MYTHS AND PITFALLS?

You should be aware of some common myths and pitfalls of computer use. First, a computer is not an electronic brain; it is a machine. It can only do what humans "program" it to do. It cannot think. Second, contrary to popular thought, there is no local government oriented, factual study yet which proves that computers --

a) REDUCE COSTS,

b) LEAD TO BETTER DECISIONS,

c) IMPROVE MANAGEMENT.

At this point, plan carefully, moving cautiously one step at a time. Most local governments that use computers seem to be pleased with results.

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6. NOT IF, BUT WHEN AND HOW?

Sooner or later you will begin using computers. The key management decisions revolve around --

a) WHEN?

b) HOW TO SELECT THE BEST WAY?

There are no pat answers to either; within your own management environment, you will have to answer both in your own way. As time moves on, your options will broaden.

On the one hand, time improves chances of successful, effective computer use; on the other hand, it complicates the decision choice. You will need more data and help for comparing alternatives.

I. SUMMARY

For any new venture in local government, a good plan and organization with a knowledgeable, motivated mixture of talents go a long way to ensure success. It is the same recipe for ensuring effective computer use in local government.

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This section identifies electronic data processing --its elements, functions, history, and characteristics.

A. DATA PROCESSING

1. DATA PROCESSING DEFINITION: Collecting and processing data to obtain usable information and communicating this usable information, i.e., getting the right information to the right person at the right time, are included under this term:
   a) DATA -- facts, unevaluated entities unlimited in number
   b) INFORMATION -- data arranged in a useful form
   c) INFORMATION FLOW -- movement of useful information into, within, and out of the structure of the organization

2. DATA PROCESSING FUNCTIONS:
   a) INPUT -- originating the data to be processed
   b) VALIDATING (CLASSIFYING) -- screening the data for validity, accuracy, and completeness
   c) SORTING -- arranging the data according to established rules dependent on a key or field in or with the information
   d) PROCESSING -- manipulating the data according to predetermined procedures which convert it to information
   e) FILING -- storing the information for future retrieval and use

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f) OUTPUT -- reproducing the information in a useful form

3. DATA PROCESSING HISTORY:

a) MENTAL -- Man's brain has always been the most significant data processor.

b) MANUAL -- Early hand-held devices such as the abacus (2,000 years old) aided man in making more rapid computations.

c) MECHANICAL -- These data processing devices were used mainly for numeric calculation as opposed to word processing.

d) ELECTRONIC -- These devices became the first true data processing (alpha and numeric) machines.

B. ELECTRONIC COMPUTERS AND DATA PROCESSING

1. ELECTRONIC COMPUTER DEFINITION: An electronic computer is a device capable of accepting data in the form of facts and figures, applying prescribed processing to the data, and supplying the results of these processes as meaningful information. This device usually consists of input and output devices, storage, arithmetic and logic units, and a control unit. The computer is controlled by internally stored programs or instructions.

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a) A program is a sequenced set of instructions to a computer to do a particular job. Programs are written by people. Each different job that is to be performed requires a different program or set of programs.

2. ELECTRONIC COMPUTERS EVOLUTION:

a) EARLY HISTORY --

(1) The adding machine was developed by an eighteen-year-old Frenchman in 1642.

(2) Jacquard used punched wooden cards to operate weaving looms in 1780.

(3) Hollerith developed the machine-readable punch card in 1887 and, by using it, he took only three years to compile the 1890 census (63 million people).

b) MODERN COMPUTER -- The "Generations" (Figure 1) --

(1) The first generation (1951-1960) featured vacuum tube circuits, single job processing, millisecond speeds, and machine and assembly language programming with very short times between CPU failures (20 mins. -- 2 hrs.).

(2) The second generation (1958-1967) is characterized by transistor circuits, large auxiliary memory, multiprogramming, micro-

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second speeds, higher level language programming, small operating systems, and more time between CPU failures (1,000 hrs.).

(3) The third generation (1964-present) developed integrated circuits, advanced auxiliary memory, microprocessing, virtual memories, nanosecond speeds, large sophisticated operating systems, and longer times between CPU failures (1-3 yrs.).
NOTE: The major motivations for technological advancement were increased speed and reliability and reduced cost. Size reduction was at best only a slight motivation.

(4) The fourth generation (late 1970s-?) is still in the developmental stage. We are on its threshold but may not be aware of its onset until after it has emerged. There is no generally accepted argument as to the specific characteristics of this generation, but it may include such features as virtual memories of tremendous size, on-line fast archival storage of unlimited capacity, either large-scale integrated hardware circuits or cryogenic circuits, multiprogramming, multipro-

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cessing, geographically distributed computer networks, microprogrammed control circuits, and picosecond speeds.

NOTE: Some of these characteristics presently exist in late third generation computers. (Figure 1)

3. TYPES OF COMPUTERS:

a) DIGITAL

Digital computers operate on discrete data by performing arithmetic or logic operations only. Modern electronic digital computers have the following characteristics:

(1) Represent data in discrete form

(2) Perform arithmetic and logic operations (count and compare)

(3) Operate on an internally stored program

(4) Store data internally

(5) Perform fundamental mathematical processes (addition, subtraction, etc.)

(6) Exercise sequential control

(7) Can be used for applications independent of the circuitry

b) ANALOG

Analog computers operate on continuous data by performing physical processes on these data. The following are characteristics of

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modern analog computers:

(1) Represent data in analog or continuous form

(2) Measure physical processes

(3) Are programmed by rearranging the circuitry

(4) Are supplied data from external sensors or by adjusting values of electronic components

(5) Perform complex math processes (solving differential equations, function generation, and integration)

(6) Perform simultaneous operations (I/O)

(7) Maintain accuracy through dependence on the calibration of the measuring devices

(8) Are used for applications dependent on the circuitry only, thus making them difficult to reprogram

c) HYBRID

A hybrid computing system contains features of both digital and analog computers; it is used for specialized applications.

4. CLASSIFICATION OF COMPUTERS:

a) PURPOSE (FOR CONFIGURATION)

(1) General purpose: A computer that is designed to handle a wide variety of problems. It can use different programs and data bases to solve different classes of problems.

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(2) Special purpose: A computer that is designed to handle a restricted class of problems. The programs and/or data are rigidly fixed for computer ruggedness, compactness, or economy; thus, the computer is not easily adapted to any purpose except that for which it was originally designed.

b) OTHER CONSIDERATIONS

There is generally a relationship between cost, size, speed, environment, and storage capacity as in the following examples (Figure 2):

(1) "Micro"

(2) "Mini" and small business

(3) Medium scale

(4) Large scale

(5) "Super"

5. ADVANTAGES OF CURRENT ELECTRONIC COMPUTERS:

a) Size

b) Speed

c) Accuracy

d) Reliability

e) Flexibility

f) Serviceability

| | 1951 FIRST | 1958 SECOND | 1964 THIRD | 1970 FOURTH |
|---|---|---|---|---|
| TECHNOLOGY | Vacuum Tubes | Transistor | Integrated Circuits | CHIP Microprocessor |
| SPEED | Millisecond 1/1,000th | Microsecond 1/1,000,000th | Nanosecond 1/1,000,000,000th | Picosecond 1/Billionth |
| FAILURE RATE | < 2hrs | < 1000hrs | 1 to 3 yrs | 2 to 5 yrs |
| SOFTWARE | No Operating System | Small Operating System | Large Operating System | Interactive System |

Chapter III, Figure 1

| CLASSIFICATION | VENDOR MARKET NAME | COST CPU & MEM | STORAGE CAPACITY | SPEED Storage Cycle | SEC. Addition | SIZE |
|---|---|---|---|---|---|---|
| MICRO | Intel MSC-8 | $216 | 1-4K Words 4-8 bpw | 2.5 μ Nanosec | 12.5 μ | |
| MINI | HP-2100A | $4K-$95K | 4-64K Words | .98 μ | .96 μ | |
| MEDIUM SCALE | IBM 360/50 | $665K | 96-524 Addressable Units | 2 μ | 4 μ | |
| LARGE SCALE | IBM 370/168 | $3396K | 1-8M Bytes | .48 μ | .15 μ | |
| SUPER | CDC Star<br>Amdahl 470 | ?<br>5.2 million | 4M Bytes<br>6M Bytes+ | .28 μ | .16 μ | |

NOTES

This section is intended to develop a very basic understanding of computer hardware in order to assess the capabilities and limitations of this management tool.

A. INTRODUCTION

Many popular notions about the computer are wrong, or at best misleading. The magic black box, the electronic brain, infinite speed, unlimited capacity, the fountain of knowledge, the ultimate decision-maker, and similar concepts need to be placed in their proper perspective.

1. A computer performs one small step at a time.
2. A procedure or algorithm must be written (programmed) to aid in the formulation and subsequent sequencing of these small steps.

B. FUNCTIONAL SECTIONS OF DIGITAL COMPUTERS

1. INPUT SECTION:
   a) Acts as a reception desk
   b) Controls the interfacing of information between the computer and the peripheral devices or communications
2. OUTPUT SECTION:
   a) Acts as a distributor of a product (information)

NOTE: At times the input/output (I/O) can be combined into a single section, depending on the peripheral devices being used.

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3. CENTRAL PROCESSING UNIT (CPU):

The CPU is made up of three elements: the arithmetic and logic unit (ALU), the memory or storage unit (memory), and the control unit. (Figure 1)

a) ARITHMETIC AND LOGIC UNIT (ALU)

This is the workhorse of the computer. It has the capability of performing all arithmetic operations (add, subtract, multiply, and divide) and performing logical operations such as comparing numbers or symbols, and testing numbers for zero, negative, or positive state.

b) MEMORY OR STORAGE UNIT

An erasable storage area within a computer which serves as a storage place for data and program instructions is called the memory unit. Its memory capacity is finite. Memory is composed of material that can be electronically charged and is either magnetic core, rods, or chips, with eight cores, rods, etc. making up a byte. Memory is referred to by byte capacity in thousands (K) of bytes (4K equal 4000 bytes of memory).

c) DATA REPRESENTATION

The computer uses circuits (switches) to represent data internally. Its internal code is based on a binary numbering system:

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(1) Combinations of binary digits (bits) are used to represent quantities (a zero or a one).

(2) Eight bits equal one byte.

(3) One byte represents one number, letter, or character. (Figure 2)

d) CONTROL UNIT

Each computer is designed to execute a finite set of instructions (commands). This set is generally referred to as the computer's instruction repertoire. Its control unit --

(1) retrieves the current instruction from its storage space,

(2) decodes the instruction and determines the function to be performed,

(3) coordinates and controls all other functional sections,

(4) maintains control of the established sequence of instructions,

(5) receives its directions completely from the program, one instruction at a time.

e) COMPUTER STORAGE

The purpose of storage is to hold data/programs and to provide a work area for data manipulation.

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(1) Primary storage (sometimes referred to as main memory, core storage, or internal memory) is the only location in which a program can be executed or data can be processed.

(a) Main memory size is expressed in thousands of bytes (Ks).

(b) Main memory speed (access time) is expressed in fractions of seconds (one/one billionth=a nanosecond or one/one trillionth=a picosecond).

(2) Secondary storage (auxiliary) is used for the storage of data/programs only. No data processing or program execution takes place in secondary storage. Secondary storage media are:

(a) Magnetic drum

(b) Magnetic disk

(c) Magnetic tape

(d) Magnetic card/stripe

(e) Cards or paper tape

(f) Microfilm

Methods of accessing secondary storage are:

(a) Direct

(b) Sequential

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(c) Memory hierarchy (Figure 3)

C. COMPUTERS' INSTRUCTIONAL CYCLE

1. In a typical computer there may be two dozen or more steps in the instructional cycle and these may be grouped into the following phases as desired by the designer:

a) GET DATA PHASE:

Data required during the action are moved to the appropriate positions. Initial location of the data may be implicit to the instruction function or may be explicitly stated in the instruction word.

b) TRANSFER PHASE:

The computer retrieves a copy of the instruction from memory to the control section.

c) MIX DATA PHASE:

This is a general term meaning to perform the basic action specified by the instruction.

d) STORE RESULTS PHASE:

Results produced by the action are moved to or left in the specified location.

2. PERIPHERAL DEVICES AND MEDIA (INPUT):

a) Card reader

b) Magnetic tape unit

c) Magnetic disk

d) Paper tape reader

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e) Typewriter (console, teletype)

f) Optical character reader (OCR)

g) Magnetic-ink character reader (MICR)

h) On-line collection (CRT, POS, etc.)

3. PERIPHERAL DEVICES AND MEDIA (OUTPUT):

a) Card punch

b) Printer

c) Paper tape punch

d) Typewriter (console, teletype)

e) Magnetic tape

f) Magnetic disk

g) Computer output microfilm (COM)

h) Visual display (CRT)

i) Audio response unit (telephone)

j) Graph plotter

D. COMPUTER HARDWARE SYSTEMS CONFIGURATIONS AND EXPANSION

1. BASE SYSTEM:

A computer system at a minimum requires the following:

a) Central processing unit (CPU)

b) Input devices

c) Magnetic file devices*

d) Output devices

*A few older card systems do not have magnetic file devices.

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2. BASE SYSTEM EXPANSION:

Some reasons for expanding are:

a) Increased data volume

b) Need for more rapid and timely input

c) Need for more rapid response

Some of the methods of expanding are:

a) Adding memory modules (extended core)

b) Adding faster or more peripheral devices

c) Obtaining a larger CPU

d) Obtaining an additional computer system

E. COMPUTER PROCESSING ENVIRONMENTS

1. TYPICAL PROCESSSING ENVIRONMENT:

a) Batch processing is where a number of similar input items are grouped together and processed during a single machine run with the same program(s) for operating convenience and efficiency.

b) Real-time processing is where transactions are processed fast enough so as to permit the results to influence the related process that is underway. Transactions are usually processed individually. Real-time systems generally require on-line processing.

2. SPECIALIZED PROCESSING ENVIRONMENTS:

a) Multiprogramming is where there is the capacity to run concurrent programs. Memory

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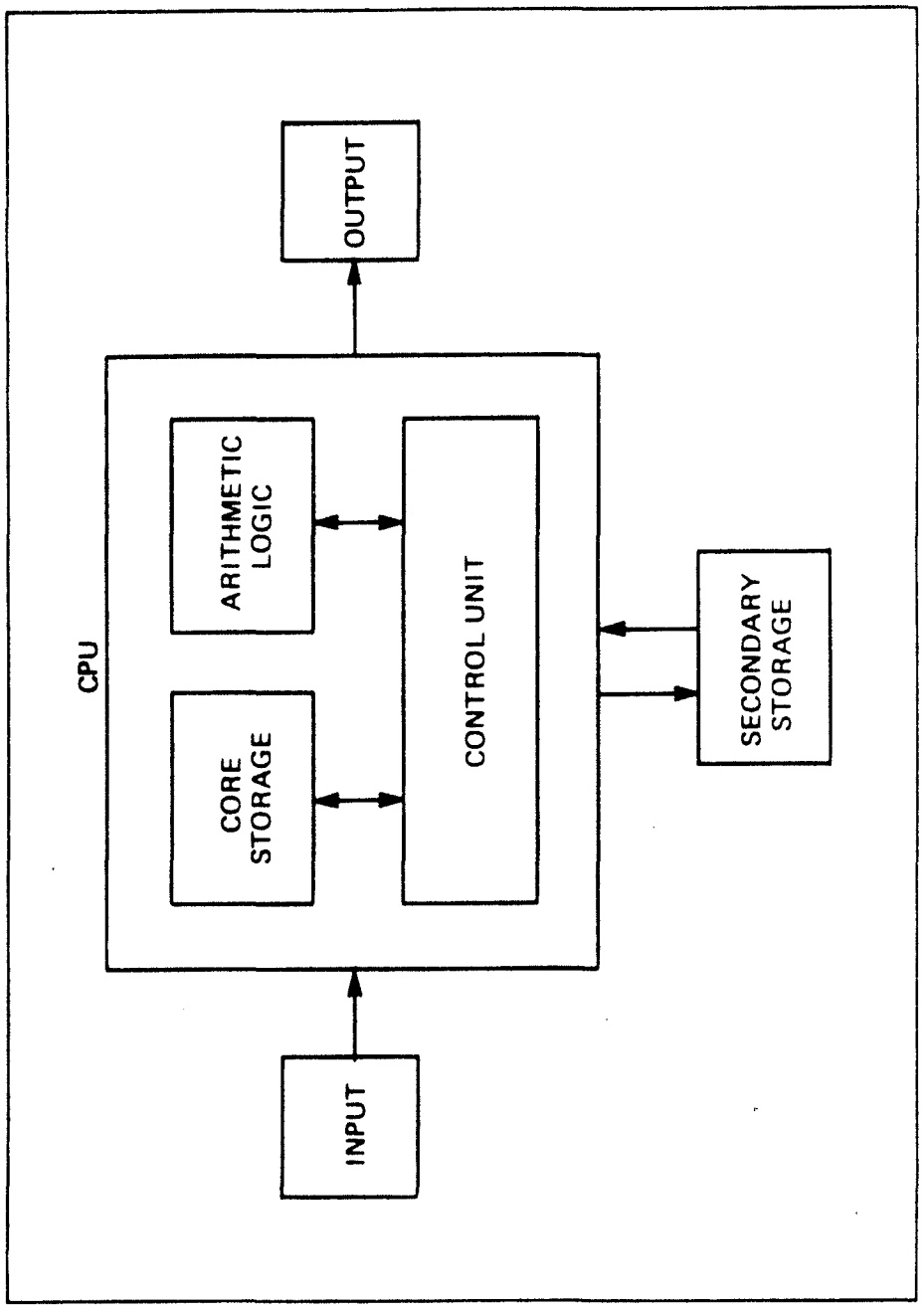
of the CPU is partitioned, and program priorities are established.

b) Multiprocessing is where two or more processors are used in a system configuration. One processor controls the system, and the others are subordinate to it.

c) Timesharing is where several independent tasks can be performed almost simultaneously by interleaving the operations of the task on a single high-speed processor. Almost simultaneously means that the independent tasks seem to be all happening at once, when not examined too closely. In fact, no more than one process at a time can occur because a single processor is involved.

F. COST

The desired hardware configuration and mode of processing must be tempered with the cost.




Chapter IV, Figure 1

BINARY CODE CHART

| $B_8$-$B_5$ ↓ / $B_4$-$B_1$ → | | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| 0000 | 0 | NUL | SOH | STX | ETX | EOT | ENQ | ACK | BEL | BS | HT | LF | VT | FF | CR | SO | SI |
| 0001 | 1 | DLE | DC1 | DC2 | DC3 | DC4 | NAK | SYN | ETB | CAN | EM | SUB | ESC | FS | GS | RS | US |
| 0010 | 2 | SP | ! | " | = | S | % | & | ' | ( | ) | * | + | , | - | . | / |
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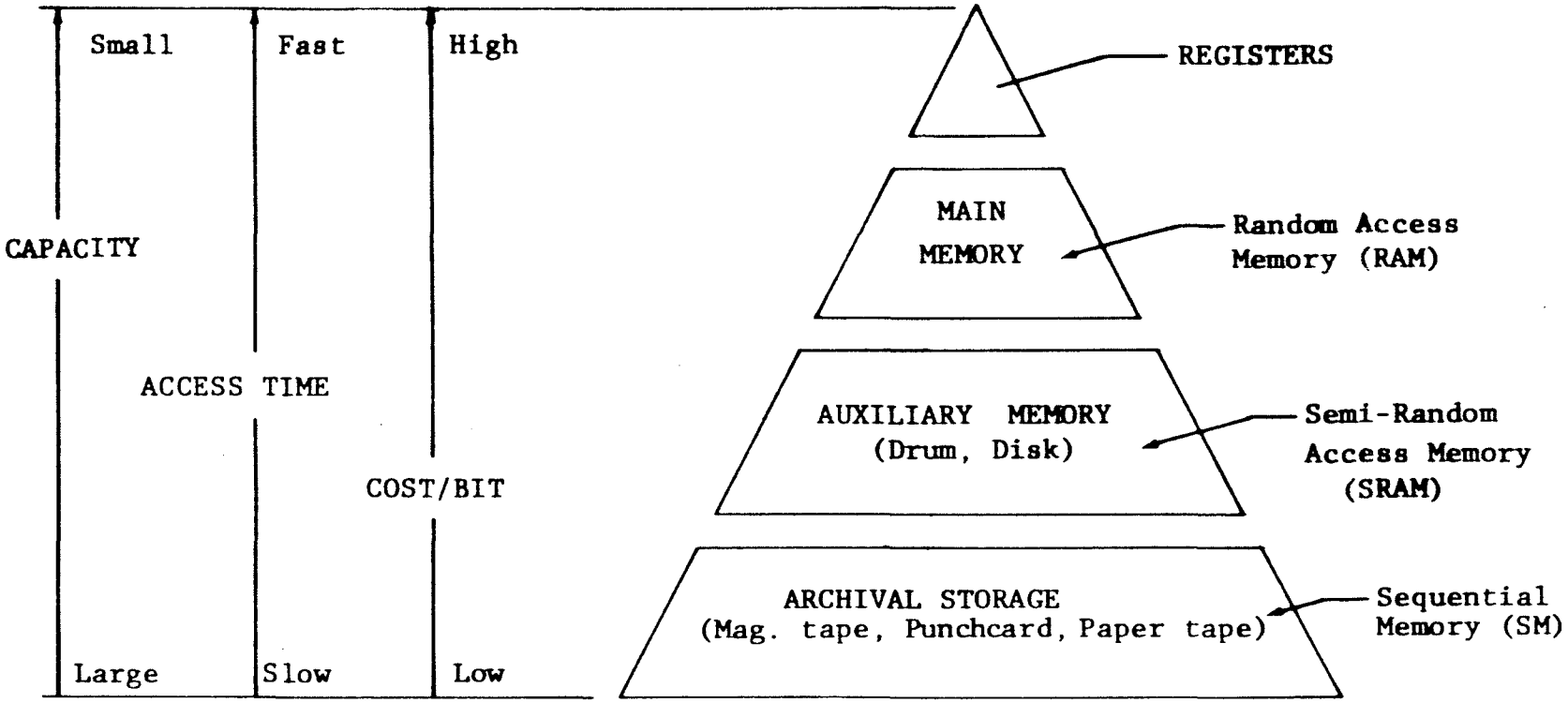
Chapter IV, Figure 2




MEMORY HIERARCHY

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This section is intended to provide a basic understanding of types of software, describe the characteristics of the most frequently used programming languages, and make recommendations about how to select software.

A. SOFTWARE DEFINITION

Technically, software is all instructions that can be read into and executed by the computer, but, in general use, software normally refers to the manufacturer's supplied program.

B. TYPES OF SOFTWARE

1. COMPUTER MANUFACTURER SUPPLIED

a) UTILITY PROGRAMS -- Programs that perform commonly needed tasks, i.e., copying data from cards to magnetic tape, dumping data from a disk file to the printer.

b) COMPILERS -- Programs that translate English-type instructions written in a high-level language, such as COBOL, to a machine-level language that the computer can understand and execute.

c) OPERATING SYSTEMS -- Sometimes called supervisors or monitors, operating systems are programs that are loaded into memory first and control the running of all the applications programs. There are many

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different types of operating systems, such as DOS (disk operating system), and OS, (operating system).

2. USER DEVELOPED SOFTWARE

   a) APPLICATION PROGRAMS -- Programs that are written by the user to produce such items as paychecks, inventory status reports, and accounts receivable.

   b) LOCAL UTILITY PROGRAMS -- Programs that are written in generalized enough form to allow their use in many different applications, i.e., programs that will print every Nth record off a file.

3. COMMERCIALLY DEVELOPED SOFTWARE

   a) GENERALIZED APPLICATION PROGRAMS -- Prewritten programs, sometimes called packaged programs, that are available for wide use, i.e., payroll packages, inventory control packages, general ledger packages. They are pretested, documented, and normally available at a fraction of the cost of writing your own.

   b) SPECIALIZED UTILITY PROGRAMS -- Programs that are marketed when the manufacturer does not have a comparable program or when the ones that are available are less efficient.

   c) MANAGEMENT INFORMATION SYSTEMS -- Prewritten programs that are designed to retrieve

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information from data bases (data files) in a more efficient manner.

## C. COMPUTER PROGRAMS AND PROGRAMMING LANGUAGES

### 1. COMPUTER PROGRAMS

A computer program, sometimes called an algorithm, is nothing more than a set of instructions that tells the computer step by step how to perform a task, e.g., to compute the average of five test scores and print the results, it might look like this:

Step 1: Read test scores.

Step 2: Add test scores to total.

Step 3: Divide total by 5 giving average.

Step 4: Print average.

Step 5: Go to Step 1.

### 2. COMPUTER PROGRAMMING STEPS

a) DEFINING THE PROBLEM -- In this step the specifications for the program are developed, i.e., input requirements, output requirements, and printer layouts.

b) DEVELOPING THE FLOWCHART -- In this step the sequence of instructions is defined:

(1) Systems flowchart -- a graphic representation of the relationship of the input and output media.

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(2) Program flowchart -- a symbolic representation of a step-by-step procedure. (Figure 1)

c) CODING THE PROGRAM -- In this step the flowchart is translated into a computer language following the rules of that language.

3. COMPUTER LANGUAGES

a) COBOL (Common Business Oriented Language) is the most popular language used in business today. It is a high-level, people-oriented language that is made up of English-like statements.

b) FORTRAN (Formula Translations) is the primary language of engineering and mathematics.

c) RPG (Report Program Generator) is a specification language designed to easily retrieve information and generate management reports. RPG is the most popular language used on batch-oriented small computers.

d) BASIC (Beginners All-purpose Symbolic Instructional Code) is a high-level language developed for use on computer systems that have on-line terminal capabilities.

e) DATA MANAGEMENT/Query Language is a non-technical, user-oriented language that permits users to format and retrieve information through the use of simple English statements.

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f) Assembler Language is a low-level, machine-oriented language used primarily for systems programming and writing utility programs.

D. INFORMATION PROTECTION

1. INTERNAL

a) STANDARD HEADER LABELS -- Disk and tape files should be built with standard header labels. Header labels contain information such as the name of the program that created the file, date created, expiration date of the file, file name, etc.

b) GENERATION BACKUP -- Each time a file is created or updated, the files that were used to produce the new files should be saved. Normally they should be kept for at least three cycles (grandfather, father, son).

c) PROTECTIVE FILE -- It is recommended that certain crucial files should be kept at a secure location away from the data processing center in case of fire, flood, etc.

E. SOFTWARE SELECTION

Software is the most important element of a total computer system. Software is what makes the system operate; therefore, the software selection process is critical to the overall system selection process. By determining the technology environment the system

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will operate in, the user functions the software must support, the method of software acquisition, and user requirements used to evaluate the software, the potential user can make the software selection process less difficult.

1. Technology environment identifies the type of system the user wants. Basically there are two types:
   a) Batch system is when all transactions are grouped together and put into the computer at one time. Output from batch system is normally in the form of printouts.
   b) On-line interactive system is when the transactions are normally put into the system through terminal devices (CRTs) as they occur.
2. User functions are those capabilities that the software must have to enable the end user to efficiently utilize the computer system. Some user functions that are desirable in software are:
   a) Unique data searches
   b) Multiple choice inquiry
   c) Related data searches
   d) Verified file maintenance
   e) Hard-copy document generation
   f) Audit reports

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3. User requirements are those characteristics that the software should possess if it is to be considered for acquisition. Some user requirements that the software should be evaluated for are:
   a) Ease of use for end user
   b) Responsiveness to user requirements
   c) Reliability
   d) Flexibility
   e) Security
   f) Ease of modification
4. Software acquisition will generally be determined by the needs and capabilities of the user, i.e., how soon does he need the software, how sophisticated are the user's needs, and what type system does he want. There are several methods of acquiring software:
   a) Develop the software in-house (home-grown).
   b) Acquire the software from the hardware vendor.
   c) Contract with a software company to develop the software.
   d) Purchase a software package.
   e) Purchase a complete system, i.e., hardware, software, support, etc. This is known as a turnkey system (special or general purpose).

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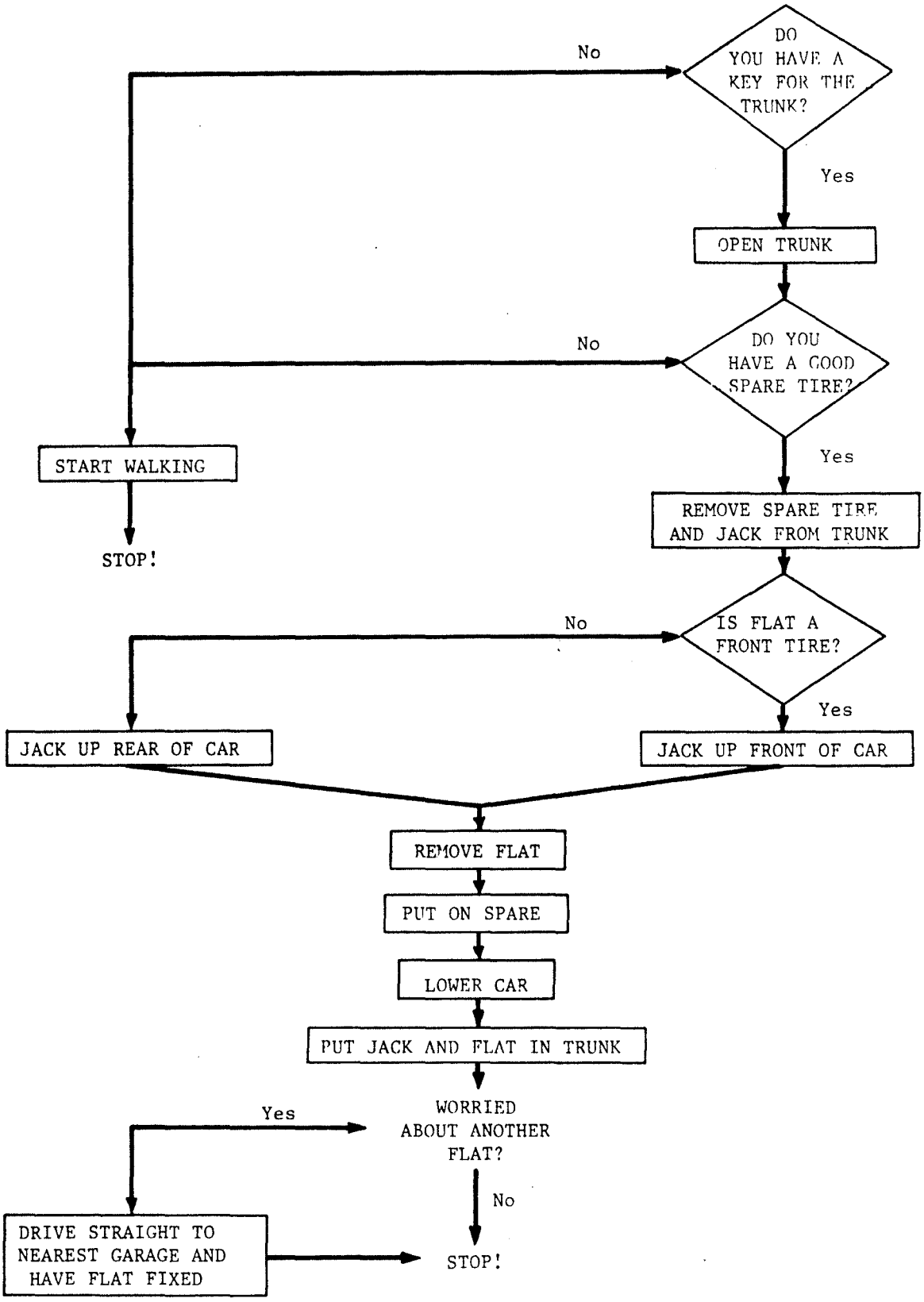
F. SUMMARY

Software is the most important element of a computer system. Eighty percent of computer system problems are caused by software failure, not hardware failure. Software is the most expensive part of a computer system because it is people-dependent. Users should be more selective and critical in the acquisition of software than hardware.




Chapter V, Figure 1

A Flow Chart for Changing a Flat Tire

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This section is an introduction to the management planning requirements for considering the implementation of an EDP system and the systems development cycle procedures to be followed when implementing a new system or adding a new application to an existing system.

## I. INTRODUCTION

### 1. MANAGEMENT

Generally the success or failure of an organization's use of EDP can be traced back to decisions made, or not made, during the initial planning and development of the system. The success of the system is normally directly related to management's --

a) SUPPORT

b) COMMITMENT

c) INVOLVEMENT

### 2. DEFINITIONS AND KEY CONCEPTS

a) SYSTEM -- Surprisingly, there is really no one correct answer to, "What is a system?" The word must be attached to some particular environment to have any real meaning. Otherwise, it is nothing more than an abstract notion of "plan" or "order," and those words would do just as well.

b) INFORMATION SYSTEM -- A prescribed process for taking less intelligible "raw" data and

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making it understandable. Ideally, an information system takes in data, superimposes order on it, and outputs "information." In a practical sense, we would hope that less comes out than goes in.

c) COMPUTER SYSTEMS -- Aggregations of hardware and specialized control programs (software). The hardware basically consists of processing circuits plus input/output devices.

d) MANAGEMENT INFORMATION -- Information needed to help management plan, direct, and control the functions of an organization.

e) COMPUTER-BASED INFORMATION SYSTEMS -- "Plans" or "processes" to process data and generate information which have been reduced to computer software, computer hardware, and people.

SYSTEMS DEVELOPMENT "CYCLE"

Although there are many different ways to express the concept of the "systems development cycle," its chief attributes are that it

--is an organized progression through a series of activities,

--is marked by "milestones,"

--has continual feedback.

In a sense the systems development cycle is a

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representation of how computer systems are brought to life. (See Figure 1.) This model also represents the evolutionary nature of any information system. The feedback to top management on how a system is operating will result in continuous modification and "fine tuning" of the system.

The major elements of the systems development cycle are --

1. FEASIBILITY PHASE

   In this phase the economic, organizational, and informational constraints are examined in detail. Organizational objectives and impact are evaluated. The principal questions in this phase are --

   a) Does the technology exist?

   b) Can we afford it?

   c) Will it fulfill our needs?

2. SYSTEMS SURVEY (REQUIREMENTS) PHASE

   The survey (requirements) phase includes the following:

   a) Definition of the user and the user's objectives

   b) Survey of the problem to determine if it is real

   c) Analysis of the problem to ensure all requirements are identified

   d) Documentation of the problem

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3. SYSTEM DOCUMENTATION (DESIGN) PHASE

This phase is critical to the implementation of the system. In this phase the detail of the system is highlighted and includes the following:

a) Definition of information needed by the user (output)

b) Identification and definition of input information

c) The layout (flowchart) of the system or application

d) Identification and definition of hardware and software requirements

4. THE PROGRAMMING PHASE

This phase is the most technical of the development cycle, and management is less involved than in any of the other phases.

This phase includes the following:

a) Design of the hardware system flow

b) Detail of the flow of program tasks

c) Coding of programs

d) Compilation of programs

e) Debugging of individual programs

f) Debugging of entire system

g) Consolidation of final documentation

5. INSTALLATION PHASE

The installation phase includes the following:

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a) Installation of system

b) Consultation with operating groups (Does the user accept?)

6. SYSTEM MAINTENANCE PHASE

The system maintenance phase is very important. It includes the following:

a) Routine operation

b) Periodic review of the system

c) Modification of the system as required

## C. FEASIBILITY STUDY PHASE OF THE SYSTEM DEVELOPMENT CYCLE

The feasibility study generally examines the following factors:

--Technical possibility

--Economic possibility

--Operational practicality

--Organizational impact

1. GOALS

The first step to successful feasibility study development is to state the goals of your organization with respect to the proposed system. General categories for such goals are the following:

a) EXPENSE REDUCTION

(1) Clerical labor costs

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(2) Supervisory time devoted to clerical management

(3) Operational costs of existing clerical systems

(4) Incidental costs of existing systems, e.g., quality of work environment and peak-load costs/real-time costs (waste), etc.

b) REVENUE RAISING

(1) Better control of revenue generating systems, such as tax digests, motor vehicle driver violations, city/county business licenses, and utility billing.

(2) "Grants management" for such programs as state subsidies to road maintenance programs and law enforcement grants.

c) IMPROVED SERVICES

(1) Direct services to the public may be improved through up-to-date data. Is there a need or public demand?

(2) Shortened internal processing time can ease interorganization friction.

(3) Information for planning can

--improve budgeting,

--monitor and better utilize county/city resources, e.g., vehicle maintenance,

--focus on evaluating alternative prob-

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lems and thus finding solutions instead of compiling data only.

d) ANCILLARY OBJECTIVES

(1) Enhancement of organizational prestige. Is this desirable and to what degree?

(2) Need to restructure existing functions. How can this need fit in with the system under study?

2. SELECTING A TEAM

After the general goals are stated, typically an organizational team is established to provide broad input from the various functions which will be affected by the system. As a rule, the team should have the following composition:

a) Peer-level managers from the affected functions, preferably the top managers in each of those activities

b) Technical consultants (either employees or persons retained) who should guide and assist, but not direct, the effort

D. FEASIBILITY STUDY METHODOLOGY

1. SURVEY OF EXISTING WORK PROCEDURES

a) Responsibility analysis

b) Task analysis

c) Problem analysis of whether current task and

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responsibility allocations get the job done effectively

2. SURVEY OF WORKER AND MANAGEMENT OPINION

a) Do managers feel that their decisionmaking information needs are being met? Is the management environment stable enough that an automated system will actually improve the managers' decision capability?

b) Do workers feel that their jobs are supported by current information availability?

--Are there delays for reports?

--Is there needless paper handling?

--Can procedures be improved? How?

--How stable are the workers' information needs?

c) In an objective determination of needs by study team, the questions are

--What are the behavioral objectives to be accomplished?

--Will retraining and reorganization be necessary?

--What does management and what do workers realistically need from the proposed system?

--What new internal procedures and time frames will be needed to operate normally with an automated system?

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3. FEASIBILITY STUDY REPORT CONTENT

The report should include these analyses:

a) Existing manual systems and supportive procedures with an estimated cost of operation for each

b) Goals for proposed systems with an estimated cost of operation exclusive of development

c) Tentative and broad-brush development time schedule

d) Tentative development cost estimates and cost options of the proposed system(s)

e) Cost impact conclusions for --

(1) No implementation (status quo)

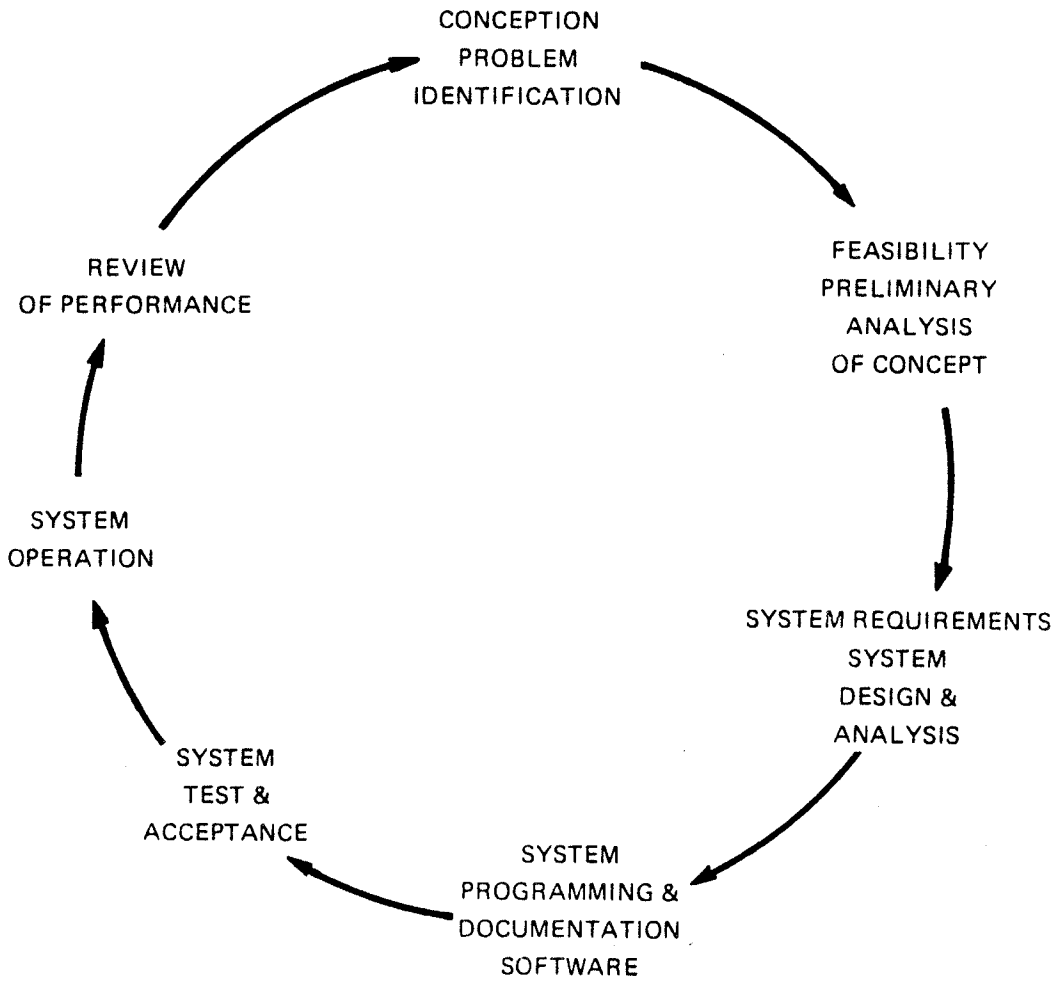
(2) Partial or "selective" implementation

(3) Full implementation with long- and short-range impact

E. ASCERTAINED DEGREE OF MANAGEMENT COMMITMENT

The commitment must exist before system development can proceed to have a reasonable chance of success.

SYSTEM DEVELOPMENT CYCLE




Chapter VI, Figure 1

NOTES

## A. INTRODUCTION

This section discusses the alternatives available to small local governments in satisfying their computer requirements.

### 1. RANGE OF ALTERNATIVES

Which alternative to select will revolve around --

a) The degree of sophistication needed and/or desired,

b) The hardware required to support the system,

c) The procedures and methods to be followed,

d) The organization available to control and direct the system,

e) Other considerations, such as

(1) Activity size

(2) Political climate

(3) Economic conditions

(4) Personnel situations

## B. SYSTEM PURPOSE

The capacity of a system to fulfill given purposes, which must be built in during the systems conceptual design, is more a function of desire, purpose, and imagination than limitations imposed by the size or nature of the equipment. There are three basic levels of system sophistication.

### 1. LEVEL 1

This is the process of having the computer do

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what was being done by hand or with non-computerized equipment prior to the conversion of the process to the computer. It is the lowest level of computer utilization, even though the size of the application may be quite large. In this mode, the computer is used as a high-speed adding machine and typewriter.

2. LEVEL 2

This is the use of the computer to operate all, or significant related segments, of an agency's work. This level especially includes the use of the computer as a low-level decisionmaker in those instances when all the factors necessary to make a decision are included in the system and judgmental qualities are not required. Examples would be the automatic sending of permit application renewals, overdue or cutoff notices for delinquent utility bills, and summonses for parking violations after prescribed periods of time.

3. LEVEL 3

This is a much higher form of the use of the computer. It involves the use of the computer to report to managerial, administrative, and technical personnel the types of analytical information (not just raw data) that will help

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them in their work of decisionmaking, direction, and follow-up. It assumes great reliance on the computer to make aggregations, summarizations, and exception analyses of operations for these purposes. Management information system and decisionmaking models are examples of these uses.

Most small local governments utilize EDP somewhere between Levels 1 and 2.

C. ALTERNATIVE APPROACHES

There are essentially three approaches a local government can take to satisfy its EDP requirements:

1. SERVICE BUREAU

   An organization equipped to provide electronic data processing services to a customer for a fee.

2. INTERAGENCY COOPERATIVE COMPUTER CENTER

   A cooperative approach in which several local governments or other political agencies join together for the purpose of sharing a computer system.

3. IN-HOUSE

   Organizational ownership and management of the computer system.

D. SUMMARY

There are no clear-cut advantages to any of these alternatives that apply to all local governments. Local government management should insist on care-

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ful exploration of all available alternatives before proceeding and should contact other local governments with experience in the various approaches. Each of the alternative approaches will be discussed in detail in subsequent sections.

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This section contains information needed by managers when considering, selecting, and evaluating service bureaus as an alternative for meeting data processing needs.

## A. HISTORICAL INTRODUCTION

The data processing service bureau concept probably began with early Egyptian and Hebrew scribes who offered their services on a fee basis. Similar skills were marketed in northern Italy during the Middle Ages. The bookkeeping techniques of stewards in feudal England provided a further refinement of data processing and by the late nineteenth century, Englich public stenographers were offering their own brand of data processing services.

During the Depression in the U.S., temporary office services were set up for the purpose of providing peak-load personnel for office work, but it wasn't until World War II, when the need for additional office space in combination with the need for peak-load personnel and equipment provided the impetus for establishing businesses to supply temporary help, that managers began handling source material on their own premises. With this convergence of personnel, equipment, and space offered on a fee basis, the data processing service center emerged.

IBM's initiation of punched-card equipment rental in 1932 was probably a defensive maneuver in the face of

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increases in lease cancellation during the Depression. Then for twenty years IBM dominated the service bureau industry, installing a selective sequence electronic digital computer in New York in 1952 and establishing the Service Bureau Corporation as a wholly owned subsidiary in 1957.

## CLASSIFICATION OF SERVICE BUREAUS

Service bureaus vary widely in terms of size, specialization, and type and control of equipment. However, they all perform some type of data processing service on a fee basis. They can be further classified as to type, method of assessing fees, kind of specialization, and type of equipment.

### 1. TYPES OF SERVICE BUREAUS

A standard technique focuses on ownership and divides bureaus into equipment manufacturer affiliates, independents, and commercial affiliates.

#### a) EQUIPMENT MANUFACTURER AFFILIATES

These service bureaus are owned and operated by computer manufacturers. They provide manufacturers with the opportunity to earn a return on their equipment, to demonstrate equipment in operation to prospective customers, and to train personnel who have leased or purchased computer hardware.

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They can be viewed as an extension of the sales function of the parent organization.

b) INDEPENDENTS

These service bureaus tend to be closely held companies, and their level of specialization is usually a function of their size. Larger bureaus focus on scientific and research applications, while the smaller ones generally have a business or commercial orientation. Most independents are not in the computer services or contract services part of the industry. They tend to emphasize processing services rather than program assistance.

c) COMMERCIAL INSTITUTIONS

Some banks with excess capacity on their in-house systems offer their applications to their correspondents on a fee basis. Their focus tends to be on business-oriented processing, programming assistance, and virtually no high-level problem solving.

Universities frequently offer time on a block-time basis. The seller may provide storage and workspace and perhaps operators as well; he does not otherwise become involved with the data processing being performed. A principal drawback of these "bureaus" is that the service

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bureau function is necessarily subordinate to other organization goals.

2. THREE METHODS FOR ASSESSING FEES

a) FIXED FEE

The fixed-fee basis of assessing cost is most usual when the client's specifications are clearly defined and there are few anticipated changes in the application. This charge may include an additional fee for each item processed. A minimum payment for each processing period for recurring jobs may be required. The minimum reflects the fixed costs associated with managing the account.

b) TIME AND MATERIALS AT A STANDARD RATE

This method of assessing costs is most suitable for applications with well-defined procedures when run time, number of runs, and number of transactions are not known. Charges are based on the amount of CPU time used to complete the run and on the cost of input and output materials.

c) FIXED FEE PLUS COST

Fixed fee plus cost is a combination of the a) and b) above. The fixed fee covers the fixed overhead cost of the service bureau. A charge (cost) is assessed for each item processed, i.e., bill printed, new account

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added, or old one deleted, etc. This method is most frequently used for customers who have changing requirements.

3. TYPES OF SPECIALIZATION

a) COMMERCIAL

b) SCIENTIFIC

c) INDUSTRY

d) FULL-LINE APPLICATIONS

Smaller bureaus are more likely to emphasize commercial and accounting applications; the larger bureaus, scientific applications. The latter usually provide staff with strong mathematical and analytical skills.

4. TYPES OF EQUIPMENT

a) UNIT RECORD EQUIPMENT

b) COMPUTERS

c) TIME-SHARING COMPUTERS

5. OWNERSHIP OF EQUIPMENT

The bureau may own or be the prime lessee of the equipment which it operates or it may lease a block of off-shift time on one or several computers and operate it with its own personnel.

C. ORGANIZATION AND METHOD OF OPERATION

1. ORGANIZATION

Figure 1 is an organization chart applicable in varying degrees to service bureaus

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of all types. The three main functions of (1) sales, (2) programming, and (3) production usually constitute the first level of management in large service bureaus, although the functions may be combined in an owner-manager in smaller bureaus.

a) SALES FUNCTION

The sales manager's primary functions involve the penetration, development, and acquisition of new and existing markets. Duties include--

(1) recommending software package programs and systems development on the basis of market analysis

(2) maintaining close liaison with the production staff in order to coordinate the sales effort with processing capacity and scheduled workload

(3) monitoring sales effort productivity

b) SYSTEMS AND PROGRAMMING FUNCTION

Managers' duties include--

(1) coordinating their efforts with sales and focusing primarily on determining systems and programming concepts for work performed by the bureau

(2) reviewing specifications submitted by sales

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(3) enforcing standards for documenting programs and standardizing procedures

(4) exercising some control over pricing and proposals

(5) distributing work within the organization through senior systems analysts to programmers and equipment specialists

(6) developing training programs for their personnel

(7) supervising the consulting function of the organization

(8) assuming final responsibility for the productivity of senior systems analysts and their teams

c) PRODUCTION FUNCTION

The manager of the production department is responsible for keypunching, quality control, and data processing, and coordinating these departments' activities among themselves as well as with sales, programming, and systems.

(1) The keypunch section head was responsibility for meeting scheduling requirements, monitoring the productivity of his section, and detecting and following up data reduction error.

(2) The head of quality control has the responsibility for keeping customer records and establishing procedures for the

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detection and correction of errors, exercising control of recurring work, and maintaining liaison with customers.

(3) The data processing section head has responsibility for efficient machine utilization and productivity.

2. METHOD OF OPERATION

a) SET UP

Once the programs have been developed and a system has been agreed upon, the client's files will be converted into master files and usually stored at the service bureau either on tape or cards.

b) PROCESSING

Source documents received from the client are logged by the quality control section of the service bureau and checked. Unless prepunched, they are then converted into machine-readable format through data reduction, and the converted documents are then verified and transferred from quality control to the data processing group. After running the job or application, the data processing group returns the results to quality control where they are checked and the master file is returned to storage.

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c) CORRECTIONS

Reports are mailed or picked up by the client together with an error listing, and the client is advised of the procedure for correcting the errors.

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## ADVANTAGES AND DISADVANTAGES OF SERVICE BUREAUS

### 1. ADVANTAGES

a) INTRODUCTION TO EDP

Getting started with a service bureau is a relatively easy way to begin the use of EDP. The service bureau can provide much of the guidance needed to establish such an operation.

b) EASIER TRANSITION

The acquisition of some of the skills necessary to EDP can be learned from the service bureau, thus providing a fairly good transition to an eventual in-house operation.

c) ECONOMY

Because many of the bulk applications can be standardized, the service bureau can offer a good, economical way to process routine and moderately large processing volumes. Examples are tax digests, payroll, and voter registration.

d) ABSORPTION OF OVERLOAD

Assuming proper selection, a service bureau can provide the added capability necessary to absorb overloads or peak-period situations.

e) HANDLING DEVELOPMENT PROBLEMS

Development problems, such as testing and debugging, can be done without interfering with existing procedures and operations. In short, use of service bureaus is less disruptive.

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2. OTHER FACTORS

A number of factors should be understood in order to clearly and completely evaluate the use of a service bureau.

a) COSTS OF SERVICES

Costs will increase directly with a demand for increased services. Costs are usually determined by unit, i.e., 25 cents per payroll check or 10 cents per utility bill, and, as units increase, costs also directly increase. An in-house computer, by contrast, might require greater initial cost, but added processing volume would require a less proportional increase in cost.

b) COORDINATION AND LIAISON COSTS

At a minimum, the user-agency will incur certain coordination or liaison costs in addition to control and data processing costs, for example, preparation of certain data in machine-readable format (such as punched cards) in-house.

c) LACK OF QUALIFIED PERSONNEL

The service bureau may not have a person qualified to design the procedures and standards necessary to properly implement the system.

In this event, a systems analysis either by

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in-house personnel or a consultant will be an added cost factor.

d) MONITORING AND FORMS AND OTHER SUPPLIES

(1) Management must of necessity devote time to monitoring and directing certain EDP activities. This will, in effect, cost the city money.

(2) EDP forms and other supplies will be needed. In most cases, this latter cost is supported by the user regardless of the type of service used.

3. PROBLEMS IN USING SERVICE BUREAUS

a) COMMUNICATION BREAKDOWNS

b) SCHEDULING DIFFICULTIES

Because the service bureau has many customers, the aftereffects of breakdowns, etc., often result in an individual customer delay that is unsatisfactory.

c) INCONVENIENT LOCATION

The physical separation causes the facilities and staff to be less accessible to the user.

d) LEVEL OF EXPERTISE

There is often a lack of skills necessary to provide services in support of the more complex or sophisticated problems of the municipality or agency.

e) INFLEXIBILITY

Although service bureaus can make changes, the costs are passed on to the user. This,

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combined with the personnel problem, often results in an inflexible situation which inhibits progress.

## E. SELECTION PROCEDURES

### 1. INDICATORS OF POSSIBLE FEASIBILITY

Applications suitable for transfer to a service bureau will usually be characterized by one or more of the following:

a) LARGE VOLUME OF WORK

b) COMPLEX COMPUTATION

c) COMPUTATIONS REQUIRING SEVERAL REARRANGEMENTS OF DATA

d) INSUFFICIENT TIME OR PERSONNEL FOR IN-HOUSE PROCESSING

If these indicators are present, the remaining steps to be taken in selecting a service bureau can be broken down into five categories: feasibility study, formulation of the proposal, screening, request for bids, and evaluation of the proposals.

### 2. FEASIBILITY STUDY

a) FORM A COMMITTEE

A committee should be formed to analyze the current manual information-processing system. It should include representatives familiar with applications being considered and should work closely with any personnel who will be affected

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by a transfer to an automated system. Including these individuals in the planning stages may reduce the problem of personnel adjustment as the project proceeds.

b) DEFINE AND DOCUMENT THE PROBLEMS

The information-processing problems that confront the organization should be defined, ranked, and studied. They should be documented by assembling forms which are used in these areas, charting the flow of work, describing the flow, and recording the paperwork.

c) DETERMINE CURRENT OPERATING COSTS

Current operating costs should include administrative and equipment costs and fringe benefits added to payroll hours. If possible, these costs should be broken down to provide figures relating the cost per unit being processed.

3. CONTENTS OF THE FINAL PROPOSAL

The proposal which will be submitted to prospective service bureaus as a basis for their bidding should be very specific and should contain the following information:

a) Statement of purpose of the processing.

b) A layout of the final reports if the format is important or a complete description of contents if the format itself is not vital.

c) A copy of the input documents (a blank one as well as a sample filled in) with a descrip-

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tion of the information fields, or a layout of the input data if machine-readable media will be furnished by the user. If the size of a data item is variable, a range should be given.

d) Number of records to be included in the master file and the expected growth factor. The estimate should give a range if there is considerable difference in activity during different periods.

e) Handling of exceptions to normal processing.

f) Specifications for frequency of processing.

g) Specifications for timeliness of processing.

h) Special requirements, for example:

(1) Extra copies

(2) Special reports required

(3) Conversion specifications, including time limits, problems, etc.

(4) Special security and control specifications

(5) Accuracy specification

(6) Alternative methods allowed

i) Acceptance testing requirements, such as a test run.

4. SCREENING

a) CONSULTATION WITH OTHER USERS WITH SIMILAR APPLICATIONS

Query other users with similar applications in your area and compile a list of suitable firms

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to investigate, contact, and ask to send a sales representative.

b) QUESTIONS TO ASK THE SALES REPRESENTATIVE:

(1) References from satisifed customers

(2) Financial statements and/or bank references

(3) The range of services his bureau offers and how many programmers and analysts it employs

(4) What experience his bureau has had with applications similar to yours

(5) What role he plays in the organization

(6) What kind of back-up equipment he has available for processing your applications

(7) What protection he offers for your files in terms of providing back-up files, valuable papers insurance, fireproof storage, and procedures governing access to files

5. BIDS

A formal agreement or memorandum of understanding should incude the following statements:

a) RESPONSIBILITY OF EACH PARTY

This statement should specify who will have responsibility for batching source documents, supplying balance tapes, and coding that needs to be done on input, as well as what reports will be provided and what the time schedule for those reports will be.

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b) QUALITY OF WORK

This statement should require the bureau to pay for rework caused by its error or omission and require you to pay if the error is yours.

c) LENGTH OF CONTRACT

The normal length of the contract will probably be six months to a year.

d) OWNERSHIP OF SPECIAL PROGRAMS

If you are to retain ownership of special programs, the agreement should provide for--

(1) Payment contingent on progress documentation

(2) Final documentation provided to you

(3) A copy of the program in machine-readable language

(4) Provisions for allowing licensing or restricting permission for the use of the program by others

6. PROPOSAL EVALUATION

Other factors are equally, if not more, important than cost:

a) EXPERIENCE WITH SIMILAR PROBLEMS

b) AVAILABLITY OF GENERAL PROGRAM PACKAGES

c) REPUTATION AND RECOMMENDATIONS

d) FINANCIAL STABILITY

e) QUALITY OF STAFF

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f) QUALITY OF SALES REPRESENTATIVE AND ACCOUNT REPRESENTATIVE

g) AVAILABILITY OF CONTROL SAFEGUARDS

h) BACK-UP PROVISIONS

i) PROXIMITY AND CONVENIENCE

j) QUALITY OF PROPOSAL

k) AMOUNT OF WORK THEY SUBCONTRACT

l) TIME-OF-COMPLETION QUOTATION

m) COST QUOTATION

n) ABILITY TO MEET TIME AND PRICE QUOTATION

o) POTENTIAL FOR HANDLING REQUIREMENTS IN FUTURE

7. CONTROL OVER IMPLEMENTATION

a) SCHEDULING OF THE CONVERSION TO THE NEW SYSTEM

b) CONVERSION OF THE MASTER FILES TO MACHINE-READABLE FORM

c) PROCEDURE FOR ACCEPTANCE TESTING

d) PERIOD OF PARALLEL OPERATION

e) OPERATING PROCEDURES

USE OF SERVICE BUREAU -- CASE STUDY (presentation by a selected practitioner)

1. BACKGROUND ON SERVICE

a) TYPE OF SERVICE BUREAU

b) ORGANIZATIONAL STRUCTURE

c) NUMBER OF EMPLOYEES

d) HOW LONG IN SERVICE BUREAU BUSINESS WITH LOCAL GOVERNMENTS

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2. OPERATIONS SET-UP

   a) HARDWARE CONFIGURATION

   b) PROCESSING ENVIRONMENT

   c) HOURS OF OPERATION

3. SERVICES PROVIDED

   a) SOFTWARE (APPLICATIONS)

   b) SYSTEM ANALYSIS

   c) PROGRAMMING

   d) CUSTOMER SERVICES

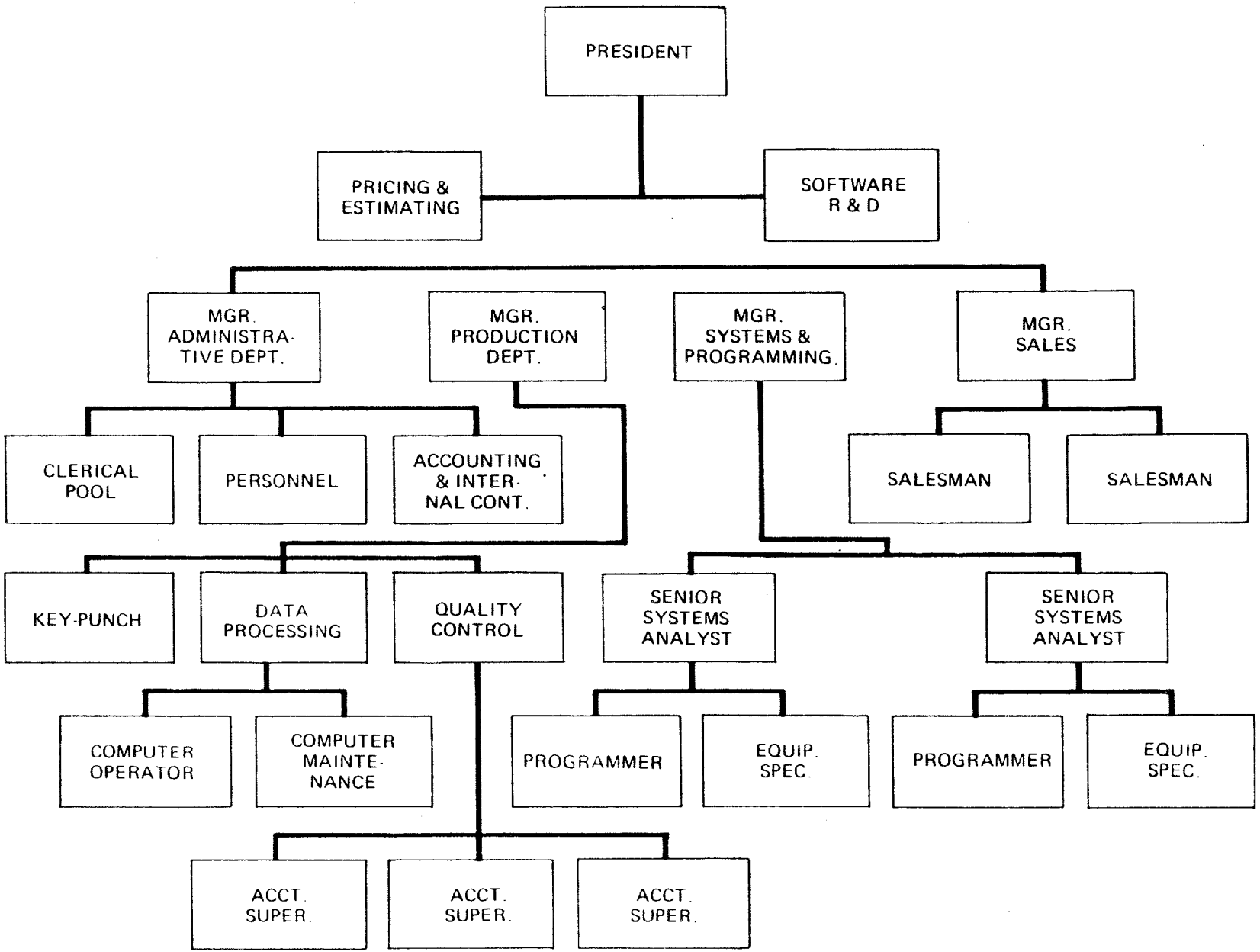
   e) FLEXIBILITY OF SOFTWARE

4. COSTING METHOD

5. CONTRACTING PROCEDURES

6. PROBLEM AREAS ENCOUNTERED IN WORKING WITH SMALL LOCAL GOVERNMENTS

SERVICE BUREAU ORGANIZATIONAL STRUCTURE




Chapter VIII, Figure 1

NOTES

This section is intended to develop an understanding of how a cooperative, resource-sharing approach can be considered an alternative in satisfying a community's data processing needs. Information needed by managers considering implementing a cooperative approach will be drawn from case studies of operating cooperative ventures.

A. COOPERATIVE APPROACHES - WHAT ARE THEY?

1. SERVICE CONTRACT -- One in which a jurisdiction or organization furnishes services to one or more jurisdictions or organizations at a predetermined fee.
2. JOINT POWERS AGREEMENT -- One in which two or more jurisdictions or organizations jointly participate in performing a function or in operating a facility.

B. CLASSIFICATION OF A COOPERATIVE APPROACH

1. According to organizational structure:
   a) Public service bureau
   b) Joint powers agreement
2. According to level of services offered:
   a) Limited services
   b) Variety of services
3. According to jurisdictional involvement:
   a) Cities-cities
   b) Cities-counties
   c) Cities-counties-school district

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d) Cities-counties-special district

e) Cities-counties-college or university

## ADVANTAGES AND PROBLEMS OF A COOPERATIVE APPROACH

1. BASIC ECONOMIES

2. ADVANTAGES:

   a) Pooling of scarce resources

   b) Transferability of applications

   c) Fostering of cooperation

3. PROBLEMS:

   a) Control by a jurisdiction limited

   b) Organizationally and financially independent

   c) Threat of withdrawal

## PLANNING FOR A COOPERATIVE VENTURE

1. SURVEY SURROUNDING AREA FOR:

   a) Possibility for cooperation

   b) Agreement on operational and political goals

   c) Jurisdictions' trust of one another

   d) Separate computer centers too expensive for municipalities involved

2. LEGAL CONSIDERATIONS:

   a) Intergovernmental agreements

   b) State laws

3. PLANNING PHASE FOR A JOINT POWERS AGREEMENT:

   a) Task force

   b) Technical assistance

   c) Feasibility study

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d) Site visits

4. ELEMENTS OF A JOINT POWERS AGREEMENT:

a) Nature of agreement and work to be performed

b) Limitations and powers

c) Financing

d) Organizational structure

e) Fiscal procedures

f) Staffing

g) Duration, termination, and amendment

5. COST ALLOCATION METHODS USED IN A JOINT POWERS VENTURE CAN BE BASED UPON:

a) Utilization

b) A predetermined cost sharing formula

c) Equal division of costs among members

6. DECISIONMAKING RIGHTS

a) Equal presentation

b) Skewed representation

E. OPERATING A COOPERATIVE ARRANGEMENT: MANAGEMENT ISSUES

1. ACQUIRING STAFF AND EQUIPMENT:

a) Data processing manager

b) Computer system vs. machine time acquistion

2. DEVELOPING AND IMPLEMENTING COMPUTERIZED APPLICATIONS:

a) Pilot test new application

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b) Management and staff training

c) Development of the cooperative budget

3. MANAGEMENT ISSUES:

a) Privacy, security of municipal data

b) General policy development and priority selection

c) Jurisdictional involvement in the cooperative

. EXAMPLES

1. Data Services Administration (DSA), Johnson County, Kansas
2. Grayson Governmental Data Center, Denison, Texas
3. Local Government Information System (LOGIS), St. Paul, Minnesota
4. Municipal Data Systems (MDS), Anaheim, California
5. Municipal Cooperative Data Processing System (MCDPS), East Providence, Rhode Island
6. Northwest Municipal Data System (NMDS), Des Plaines, Illinois
7. Public Agencies Data System (PADS), Irvine, California
8. Regional Information System (RIS), Lane County, Oregon
9. Coastal Plain Area Planning Development Commission, Valdosta, Georgia
10. Clayton County Data Center, Jonesboro, Georgia

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This section identifies and discusses factors to be considered when evaluating the choice of an in-house computer operation.

## A. INTRODUCTION

The choice of an in-house computer operation is a most difficult one to assess yet is one of the most attractive alternatives. Why? Because it gives control over operation of equipment, personnel, and scheduling. This is very important to small local governments.

## B. PLANNING FOR IN-HOUSE OPERATIONS

The planning for an in-house computer system consider five major factors - hardware, software, personnel, organizational location, and physical facilities, but not necessarily in that order.

### 1. HARDWARE

Purchase, lease, or rent are the normal options available for the acquisition of computer hardware. Each option offers the exchange of money for flexibility.

a) PURCHASE -- The purchase option usually results in the least cost in the long run (5-7 years) but requires a large initial capital outlay.

(1) Advantages

(2) Disadvantages

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b) LEASE -- The most frequently used option is lease. This includes the lease with option to purchase at a later date.

(1) Advantages

(2) Disadvantages

c) RENT -- Equipment rental is the least used option for computer systems.

(1) Advantages

(2) Disadvantages

2. SOFTWARE

The two basic options for the acquisition of software are to develop your own or acquire from an outside source. Software is difficult to evaluate and there are no fixed options. Normally small local governments use a combination of the two options to satisfy software needs.

a) IN-HOUSE DEVELOPMENT OF SOFTWARE -- This option requires the organization to establish and manage its own EDP staff. It is normally more expensive and time-consuming but is more responsive to the organization needs.

b) PURCHASE OF SOFTWARE -- The acquisition of software from an outside source normally provides for more of a rapid implementation of application.

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3. PERSONNEL

The key to your EDP operation will be the people you select to manage and operate the system. Without a doubt the acquisition, training, and retention of qualified personnel will be your most demanding and difficult task. You must select personnel to perform the following functions. (Normally in small local governments a single person will perfrom several functions.)

a) DATA PREPARATION AND HANDLING PERSONNEL --

(1) Input preparation personnel

(2) Librarians

(3) Control personnel

b) COMPUTER OPERATIONS -- In addition to powering up, operating, and powering down the computer, a computer operator must be able to detect, read, and react to computer problems.

c) COMPUTER PROGRAMMER -- A computer programmer must be creative, tolerant of detail, and, above all, accurate. For small local governments, only a programmer with two to three years' experience should be considered.

d) SYSTEMS ANALYST -- A systems analyst must be imaginative, logical, and unusually initiative. He must be able to communicate effectively.

e) EDP MANAGER -- "A good one is hard to find."

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An EDP manager should be well qualified in the technical aspects of EDP plus have knowledge concerning the functions and operations of the organization. Above all, he must have managerial abilities.

4. LOCATION OF EDP ORGANIZATION

If the EDP organization is to maximize its capabilities and be most effective, it should be under the supervision of top management and not placed within a department. Normally it will be placed under the supervision of the finance or utilities department.

5. PHYSICAL FACILITIES

The requirements for computer facilities should include:

a) Central location to all operations as possible

b) Necessary environmental controls

c) Adequate space for:

(1) Offices

(2) Storage

(3) Work

(4) Customers

Don't leave the decision up to the programmer and vendor.

# CHAPTER XI - GETTING MANAGEMENT INVOLVED: THE PROCUREMENT PROCESS

NOTES

This section is concerned with the process that a local government should use for the evaluation, selection, and procurement of computer systems and services. Examples of the Request for Proposals (RFP), computer vendor proposals, evaluation and selection criteria, and computer system contracts and contract clauses are used to emphasize the important elements of the total process.

## A. INTRODUCTION

The procurement process--Purchasing and developing a system that nobody wants and nobody ever uses once it is installed clearly ranks as one of the worst fears of any manager. And well it should because it has happened too often in the past, and the potential clearly exists for it to happen again.

The root causes of this issue involve both procurement and nonprocurement issues, and there are no easy answers or tricks of the trade which will ensure that you do not make a mistake. But, as with most things, there are precautions you can take and strategies you can employ that will minimize your risks. Our purpose here will be to explore some of these factors.

The most important point to bear in mind when approaching the procurement process is to remember that it is a process, a process which will involve numerous steps. You must have the patience to follow through each of those steps, trying not to take short cuts along the way.

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## IDENTIFYING THE ALTERNATIVES -- THE FIRST STEP

The first step in the procurement process is to identify which development alternative you are going to follow. As was pointed out earlier, there are a number of basic alternative paths for development which any local government could follow. You will have to choose the route you and your organization are going to take before you begin the formal procurement steps.

You cannot compare a cooperative venture arrangement with a private service bureau anymore than you can compare apples with oranges. But once this basic choice has been made, you can proceed with the preparation of the Request for Proposal (RFP).

## THE REQUEST FOR PROPOSAL

The primary purpose of a RFP is to translate the information needs you have identified within your organization into a form (i.e., written and as specific as possible) that the vendors can respond to.

1. GENERAL ISSUES

   a) Differentiate between your needs and wants. You should be able to separate out those characteristics that are mandatory from those that are simply desirable; in other words, you should be able to prioritize.

   b) Be detailed in your specifications rather than generalized. This approach has the advantage

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of giving you more control over the decision-making process. (For the most part, you will find that vendors do not need to be encouraged to use their imagination.)

c) Use a standard format; make sure that your RFP is "devendorized." You have gone this far doing it right; don't lose your advantage at this point by writing a "sweetheart" RFP.

2. THE CONTENTS OF THE RFP

a) GENERAL INSTRUCTIONS

(1) Purpose

(2) Proposal submission procedures

(3) Proposal conditions

b) EVALUATION PROCESS

(1) Schedule of events

(2) Proposal format

(3) Oral presentation

c) NEW SYSTEM REQUIREMENTS

(1) General requirements

(2) Current system

(3) Constraints

(4) System hardware

(5) System software

(6) Application software

d) APPENDIXES

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3. BIDDERS' CONFERENCE

Having said that you should put it all in writing, it must be recognized that your written RFP will not answer all vendors' questions and provide them with all the information necessary for them to prepare an adequate bid. The bidders' conference is where you cover these other points. There are two things worth noting about the proper way to hold a bidders' conference:

--You do it after you have defined the parameters of the procurement.

--You hold these oral discussions in public with all potential bidders present.

## BID REVIEW AND SELECTION

Once you have received the various vendor proposals, you must review, evaluate, and then select from among them the one you are willing to accept. There are several elements in this review and selection process worth noting.

1. SELECTION COMMITTEE

The official purpose of such a group is to make a recommendation to council/commission as to which of the bids submitted should be accepted. In more practical terms, the committee approach serves to ensure that all of the relevant users will be involved in what is clearly an important decision

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for the community. Among the people who could or should be included on the selection committee are the following:

a) Members of council/commission

b) Mayor/chairman/judge

c) Manager/administrator

d) Financial director

e) Clerk

f) Auditor

g) City/county attorney

h) Key user department heads

2. EVALUATION

The first round of the evaluation process involves a kind of prima facia assessment of the bids. This step is designed to weed out those which clearly do not meet the specifications called for in the RFP.

Once you have completed that step, you may wish to schedule oral presentations by those bidders willing to make them. The logic here is the same as that calling for the holding an "oral" bidders' conference after you have issued a (written) RFP. Finally, you begin your detailed evaluation of those proposals which are still in contention. The goal is, of course, to be as rigorous and as orderly as possible in conducting this evaluation,

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but it must be recognized that, in the end, the final judgments will involve a substantial subjective component. Among the factors to be considered in this review are:

a) HARDWARE (including communications)

   (1) Mandatory features

   (2) Desired features

   (3) Cost (lease vs. purchase)

b) SOFTWARE

   (1) Mandatory vs. desired features

   (2) Cost (including special license fees)

c) MAINTENANCE

   (1) Hardware and software

   (2) Field office available

   (3) Emergency back-up costs

d) WARRANTIES (for hardware and software)

   (1) Coverage and duration

   (2) Cost

e) TRAINING

   (1) Quality

   (2) Availability (on-site or remote)

   (3) Cost

f) EXPANDABILITY

   (1) Hardware and software

   (2) Cost

   (3) Flexibility

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g) DOCUMENTATION (on user manual, applications software, system hardware, and operating system)
   (1) Quality
   (2) Cost

h) VENDOR ORGANIZATION
   (1) Stability
   (2) Financial health
   (3) Reliability

i) VENDOR COOPERATION
   (1) On drafting RFP
   (2) On willingness to negotiate with community
   (3) On delivery, testing, and acceptance of software
   (4) On providing references for site visits

j) FACILITY PREPARATION
   (1) Vendor requirements for electrical power, ambient temperature, and humidity
   (2) Storage space for maintenance equipment

k) SUPPLIES
   (1) Availability
   (2) Costs

l) SECURITY
   (1) Hardware
   (2) Software
   (3) Cost

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3. SITE VISITATION

Once the selection committee has reviewed all the bids and developed a short list of those which are most attractive, they will undoubtedly want to visit one or more sites where their "most desired" systems are installed and operating to assess the utility of the system in that environment. When selecting the locations for site visits, first, be sure that the operating environment is functionally equivalent to your own community's; and second, be sure you have prepared your list of questions to ask before you begin your visit so that you won't waste your time or your host's.

CONTRACTING

This is the final step in the procurement process. Once you have selected the two top vendors, you must negotiate a contract with one of them. The fundamental purpose of this document is to afford you protection as you embark on this new venture. You should be prepared to pursue this process as vigorously as any other contracting situation you might become involved in -- maybe even more so. One point to bear in mind throughout; be sure that the contract you develop is your contract, not the vendor's. There is a big difference between the two.

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Among the features which would be covered in the contract are:

1. HARDWARE
   a) Delivery and installation
   b) Systems performance
   c) Compatibility
   d) Service/maintenance
   e) Documentation
   f) Training
   g) Price protection
2. SOFTWARE
   a) Documentation
   b) Installation
   c) Maintenance
   d) Price protection on future upgrades
   e) Rights to modify
3. SOFTWARE DEVELOPMENT
   a) Project phases
   b) Documentation
   c) Installation, testing, modification
   d) Title transfer
   e) Training
   f) Maintenance
4. PROCESSING SERVICES (for service bureaus)
   a) Turn-around time
   b) Access/security
   c) Equipment
   d) Changes in fee schedule

# GLOSSARY OF COMPUTER TECHNOLOGY TERMINOLOGY

# GLOSSARY OF COMPUTER TECHNOLOGY TERMINOLOGY

address - A number or reference name that identifies a memory location where information is stored.

algorithm - A defined process or set of rules that leads to and assures development of a desired output from a given input. A sequence of formulas and algebraic/logical steps to calculate or determine a given task.

alphabetic character - A character that belongs to the set of letters, A B C D E F G H I J K L M N O P Q R S T U V W X Y Z, and the space ( ) character.

alphanumeric - Pertaining to a character set that contains both letter and numerals, and usually other special characters.

The American National Standards Institute (ANSI) - Composed of representatives from industrial firms, technical societies, consu organizations, and government agencies. This group develops and approves such things as technical terminology, symbols, abbreviat coding structures, performance characteristics, methods of rating etc. Because the organization was known formerly as the United States of America Standards Institute, this group is sometimes referred to as USASI.

American Standards Code for Information Interchange (ASCII) - A unifor code in which alphabetic, numeric, and special characters plus several special symbols are represented by 8-bit configurations.

analog - Pertaining to data in the form of continously variable physical quantities or to devices that operate on such data.

analog computer - A computer that operates on analog data by performin physical processes on these data, in contrast to digital computer

application program - Standard and frequently used programs that are tailored to a user's needs; i.e., retail businesses, hospitals, truck lines, etc. Programs may be supplied to the user by the manufacturer, purchased from a software house, or written by the user himself.

arithmetic logic unit (ALU) - The portion of the hardware of a computer in which arithmetic operations are performed.

assembler - A computer program that operates on symbolic input data to produce machine instructions. An assembler generally translates input symbolic codes into machine instructions, item for item, and produces, as an output, the same numbers of instructions or constants that were defined in the input symbolic codes.

automatic line find (ALF) device - A unit on a carriage-type accountin computer that has the ability to read/write information from the magnetic stripe on a ledger card and to align the card to a parti posting line.

# GLOSSARY OF COMPUTER TECHNOLOGY TERMINOLOGY

ch processing - Data processing in which numbers of similar input data items are grouped together and processed during a single machine run with the same program for operating convenience and efficiency.

ch transmission - The transmission of several transactions at one time, as opposed to the transmission of each transaction as it occurs (conversational).

d - A unit of transmission speed equal to the number of signal changes in one second. The relationship of bauds to bits-per-second depends on the data set's design. In some data sets, 1200 bauds are equivalent to 1200 bits per second, a one-to-one relationship. In other data sets, the baud rate may be 1/2 or 1/3 of the bit-per-second rate.

ary - Consisting of, or marked by, two things or parts; relating to, being, or belonging to a system of numbers having two as its base.

ary-coded decimal (BCD) - Describing a notation in which the individual decimal digits are represented by a pattern of four bits, e.g., the number 12 is represented as 0001 for 1 and 0010 for 2, respectively, and thus reads 0001 0010. In pure or straight binary notation, 12 is represented as 1100.

(binary digit) - The smallest element of binary machine language represented by a magnetized spot on a recording surface or a magnetized element of a storage device. Whether the bit represents a 0 or a 1, i.e., is ON or OFF, is determined by ascertaining whether the magnetism was created by a positive or negative electrical charge.

ck - A physical unit of data that can be conveniently stored by a computer on an input or output device. The term is synonymous with physical record. The block is normally composed of one or more logical records or a portion of a logical record.

- Abbreviation for bits per inch.

nch - To depart from the normal sequence of executing instructions in a computer.

e - A sequence of adjacent bits operated upon as a unit and usually shorter than a word. NCR's Century System uses a byte of eight bits plus one parity bit.

hode ray tube (CRT) - A vacuum tube in which a beam of electrons can be focused to a small point on a luminescent screen and can be varied in position and intensity to form a pattern. The CRT can be used as an output terminal for computer systems.

# GLOSSARY OF COMPUTER TECHNOLOGY TERMINOLOGY

central processing unit (CPU) - The central processor of the computer system contains the internal memory unit (memory), the arithmeti logic unit (ALU), and the input/output control unit (IO control)

channel - A path along which signals can be sent, e.g., data channel, output channel. Also, that portion of a storage medium that is accessible to a given reading station.

character - One of a set of elementary symbols which may be arranged groups to express information. The symbols may include the deci digits 0 through 9, the letters A through Z, punctuation marks, operation symbols, and any other single symbol which a computer may read, store, or write.

code - A system of symbols representing rules for handling the flow o processing of information.

coding - Writing instructions for a computer either in machine or nonmachine language.

command - The portion of an instruction which specifies the operation be performed. A term used with hardware operations.

Common Business Oriented Language (COBOL) - A specific computer langu by which business data processing procedures may be precisely described in a standard form. The language is intended as a mea for directly presenting any business program to any suitable com for which a COBOL compiler exists and also as a means of communi such procedures among individuals.

common carrier - A company or organization, licensed by the Federal Communications Commission (FCC), whose business is to provide public transmission facilities.

communication channel - A telephone line or facility provided by a common carrier.

communication multiplexor (also called communication controller) - A hardware device that allows the data from two or more telephor to enter a computer's memory. It also compensates between the h internal speed of the CPU and the slower transmission speed over the communication channel.

compiler - A computer program that operates on symbolic input data tc produce machine instructions. A compiler is more powerful than assembler. It is able to replace certain input items with a ser of instructions. The program which results from compiling is a translated and expanded version of the original program.

computer - A device capable of accepting data in the form of facts ar figures, applying prescribed processes to the data, and supplyir the results of these processes as meaningful information. This device usually consists of input and output devices, storage,

arithmetic and logic units, and a control unit. Usually, an automatic, stored-program machine is implied.

puter output microfilm (COM) - A system that allows a computer user to produce microfilm copies of computer output. The COM unit operates independently of the CPU and is therefore called an off-line device. Output from computer processing is recorded on magnetic tape which is later removed from the computer's tape handler, mounted on the COM unit, and recorded on microfilm.

puter word - A sequence of bits or characters treated as a unit and capable of being stored in one computer location. Synonymous with machine word.

sole - That part of a computer used for communication between the operator or maintenance engineer and the computer.

trol unit - Often called the input/output control unit of I/O controlle That portion of the hardware of a digital computer which directs the sequence of operations, interprets the coded instructions, and initiates the proper commands to the computer circuits to execute the instructions. The control unit also affects selection and retrieval of data from storage or from outside the computer.

versational mode - A data transmission method in which every transaction originating at a remote point requires a response from the central computer's file.

a - A collection of facts or figures.

a base - All the information that exists at any time. A corporate data base is all the information that exists in the company at any time. An application data base is all the information about one part of the company's activities (production, sales, financial accounting, etc.).

a processing - The collection of data, processing of the data to obtain usable information, and the communication of this usable information.

a set - A hardware device that converts digital pulses (square wave form) into modulated frequencies (sinsoidal wave form) for transmission, a process called modulation. It also converts modulated frequencies into voltage pulses, a process called demodulation. Data set is synonymous with modem.

a transfer rate - The rate at which data is transferred between the peripheral unit and the central processor's memory.

- A collection of punched cards.

sity - The closeness of space distribution on a storage medium.

detail flowchart - A diagram that illustrates the order of execution of individual program steps.

digit - A single symbol or character representing a quantity.

digital computer - A computer that operates on discrete data by performing arithmetic and logic processes on these data. Contra with analog computer.

direct access - Pertaining to a storage device or procedure in which access to a particular address is such that the time required to transfer a unit of information to or from the storage device is independent of the location or address which is accessed. Th the access time for each storage location is the same.

direct access storage device (DASD) - A device used for storage of direct access files. It could be a magnetic disk or drum.

disk pack - A set of circular magnetic surfaces for storage of file information. The disk pack can be used for storage of serial or direct access files.

drum storage - A type of addressable storage which uses magnetic recording on a rotating cylinder.

electronic data processing - EDP.

execution time - The time at which an object program is executed.

Extended Binary Coded Decimal Interchange Code (EBCDIC) - A 256-character data representation code.

external storage - Storage media separate from the machine, but capable of retaining information in a form acceptable to the computer, such as tapes, disk packs, punched cards.

field - A unit of data within a record or area. A logical grouping of continuous characters.

file - A collection of records, an organized collection of informatic directed toward some purpose. The records in a file may or may not be sequenced according to a key contained in each record.

file directory - A directory on a direct access file medium that contains the pertinent information about the files that are held on that file medium.

firmware - A special type of relatively permanent program that takes the place of, or accomplishes the function of, traditional hardware components. Firmware is loaded into the equipment

either at the time it is manufactured or later--by the person installing the equipment or the person using the equipment.

ed-length record - A record with a fixed number of characters.

wchart - A graphical representation of a sequence of operations using symbols to represent the operations.

mula translator (FORTRAN) - A programming system, including a language and a compiler, allowing programs to be written in a type of mathematical language. These programs are subsequently translated by a computer into machine language.

l duplex - A facility that allows simultaneous two-way transmission.

f duplex - Nonsimultaneous two-way data transmission.

'd copy - A printed copy of machine output in a readable form, such as output from a printer.

'dware - The mechanical, magnetic, electronic, and electrical devices or components of a computer.

.d - A device which reads, records, or erases information in a storage unit. The head is usually a small electromagnet used to read, write, or erase information on a magnetic surface. It could also be the set of perforating or reading fingers and block assembly for punching or reading holes in paper tape.

.lerith Code - The code most commonly used to punch information into punched cards.

'ormation - A meaningful collection of data.

'ormation retrieval - The methods and procedures for recording specific information from stored data.

)ut - The data to be processed.

)ut/output - I/O

)ut/output control (I/O control) - The portion of the central processor of some computer systems which contains electronics for supervising data flow between memory and the input/output devices connected to the central processing unit.

;truction - A set of characters, together with one or more addresses, that defines an operation and which, as a unit, causes the computer to operate accordingly on the indicated quantities. A term associated with software operation.

# GLOSSARY OF COMPUTER TECHNOLOGY TERMINOLOGY

internal storage - Storage facilities forming an integral physical p of the computer and directly accessible to the arithmetic and control units of the computer.

keypunch - A special device to record information in cards by punchi holes in the cards to represent letters, digits, and special characters.

label - One or more characters used to identify an item of data. Synonymous with key.

language - A defined set of characters that is used to form symbols, words, etc., and the rules and connections for combining these into meaningful communications.

left justified - Data is left justified when the leftmost digit or character occupies the leftmost position of the space allotted f that data.

load - In programming, to place data into internal storage.

logic flowchart - A flowchart of a program or portions of a program showing the major logical steps intended to solve a problem. Logic flowchart is synonymous with function flowchart.

machine language - A language designed for interpretation and use by a computer system without translation.

magnetic disk - A storage device consisting of magnetically coated disks, on the surface of which information is stored in the form of magnetic spots arranged in a manner to represent binary data. The disk is usually used as a file medium.

magnetic ink character recognition (MICR) - A check-encoding system employed by banks for the purpose of automating check handling. Checks are imprinted (using magnetic ink) with characters of a type face and dimensions specified by the American Banking Association. There are 14 characters (the numbers 0-9 and four special symbols) which are used to provide amount, identifying, and control information.

magnetic tape - A continuous, flexible, recording medium whose base material is impregnated or coated with a magnetic-sensitive material ready to accept data in the form of magnetically polari spots.

management information systems (MIS) - The specific type of data processing system that is designed to furnish management with information that may be of assistance in decisionmaking.

# GLOSSARY OF COMPUTER TECHNOLOGY TERMINOLOGY

ster file - A file of semipermanent information which is usually updated periodically.

mory - Any device into which a unit of information can be copied, which will hold this information, and from which the information can be obtained at a later time. Usually, memory is an internal part of the CPU. An internal, erasable storage area.

dem - A device that provides the appropriate interface between a data processing machine and a communications line. It converts data originating in digital form into analog signals suitable for transmission over telephone lines (and vice versa).

f-line - Pertaining to the operation of input/output devices or auxiliary equipment not under direct control of the central processor

-line - A system, or peripheral equipment or device in a system, in which the operation of the equipment is under control of the central processing unit. Information reflecting a current activity is introduced into the data processing system as soon as it occurs.

erating system - A set of interrelated software modules which provides the framework for the orderly assignment of a computer installations's resources to the execution of a variety of applications.

tical character recognition (OCR) - The identification of graphic characters by use of photosensitive devices.

tical reader - A piece of hardware whose operation is based on the principle that the special shape of each character printed on the input media is capable of being identified by a reading device. As the optical reader reads each character from the input media, it translates the data into electrical impulses that, in turn, are transmitted to the computer for processing. The optical font characters can be output from accounting machines, adding machines, or cash registers.

tput - The transfer or exit of processed or in-process information from a system, location, or area to a destination or external point.

ripheral units - Those input/output devices that are cable-connected on a truck to the central processing unit (CPU).

inter - A device capable of producing hard copy in the form of printed reports, invoices, etc. Most computer printers print a line at a time.

ogram - A sequenced set of instructions to a computer to do a particular job.

# GLOSSARY OF COMPUTER TECHNOLOGY TERMINOLOGY

program language - A language which is used by programmers to write computer programs and routines.

programmer - A person who prepares and plans the sequence of events that a computer must undertake in order to solve a problem.

programming - The art of reducing the plan for the solution of a proble to machine-readable instructions.

punched card - A card which may be punched with holes to represent let digits, or characters. A rectangular piece of thin but bend-resistant material used as a medium for storage of information. One type of card is 7-3/8 inches long by 3-1/4 inches wide and co 80 columns, each of which contains 12 punching positions.

random access - Access to storage under conditions in which the next position from which information is to be obtained is in no way de on the previous position. Also called direct access.

real-time processing - The processing of information or data at the ti the data is created. The results of the processing are available quickly enough to influence the process which creates the data.

record (noun) - A group of one or more words containing related inform about a common subject. One or more records make up a file.

record (verb) - To copy, or set down, information in some form for fut reference. To make a transcription of data by a systematic alter of the condition, property, or configuration of a physical medium, such as placing information on magnetic tape or magnetic disk by magnetic spots.

register - A term used to designate a specific computer unit for storir a group of bits or characters.

right justified - Data is right justified when the rightmost digit or character occupies the rightmost position of the space allotted fc that data.

routine - A set of instructions arranged in proper sequence to direct the computer to perform a desired operation or series of operation

run - One performance of a program on a computer; performance of one routine, or several routines automatically linked so that they for an operating unit, during which manual manipulating by the compute operator is usually not required.

sequential processing - A type of processing in which the records in a file are accessed serially. Also called serial processing.

# GLOSSARY OF COMPUTER TECHNOLOGY TERMINOLOGY

)ftware - Various programming aids that are supplied by the manufacturer to facilitate the user's efficient operation of the equipment. The collection of programs, routines, and documents associated with a computer, e.g., compilers, library routines.

)urce language - A language that is an input to a given translation process.

)urce program - A program coded in other than machine language that must be translated into machine language before being executed.

)ecial character - A character that belongs to the following set:

| | |
|---|---|
| + | Plus sign |
| - | Minus sign |
| * | Asterisk |
| / | Stroke (slash) |
| = | Equal sign |
| , | Comma (decimal point) |
| ; | Semicolon |
| . | Period (decimal point) |
| " | Quotation mark |
| ( | Left parenthesis |
| ) | Right parenthesis |
| > | Greater than symbol |
| < | Less than symbol |
| $ | Dollar sign |

orage - A device or portion of a device that is capable of receiving data, retaining it for an indefinite period of time, and supplying it on command.

broutine - The set of instructions necessary to direct the computer to carry out a well-defined mathematical or logical operation; a subunit of a routine.

stem - An assembly of procedures, processes, methods, routines, techniques, or equipment united by some form of regulated interaction to form an organized whole.

stem flowchart - A pictorial diagram illustrating the flow of information into, through, and out of a system of programs.

rminal - A point in a system or communication network at which data can either enter or leave.

me-sharing - The use of a central processor for two or more purposes during the same overall time interval. Time-sharing is done by interspersing in time the actions of the peripheral units and the central processor.

# GLOSSARY OF COMPUTER TECHNOLOGY TERMINOLOGY

transaction data - A set of data in a data processing system, a record of occurrence of a new event or transaction in which the incidenc of the data is essentially random and unpredictable.

transaction file - A file containing current information related to a data processing activity and used to update a master file.

virtual storage - A method by which the internal memory of the CPU can extended almost without limit. Each program run on a computer using virtual storage is divided into segments called pages. The entire program is then stored on some direct access medium, and t pages of the program are called into memory as they are needed fo execution.

# EDP PERSONNEL JOB DESCRIPTIONS

# AND CLASSIFICATIONS

# EDP PERSONNEL JOB DESCRIPTIONS AND CLASSIFICATIONS

## A. DATA PROCESSING MANAGER

### 1. NATURE OF WORK

This is responsible administrative and technical work in planning, organizing, and directing a computer center. Work is performed within established policies and procedures, but with complete technical independence, and is reviewed by management through conferences and reports. Work involves--

a) Supervising and participating in the programming, systems analysis, and operational activities of the data processing center.

b) Reviewing and approving the application of new systems to the computer.

c) Establishing development and operational priorities.

d) Supervising directly or through subordinate supervisors all employees of the center.

### 2. EXAMPLES OF WORK

a) Plan, organize, direct, and participate in the programming, systems analysis, and operational activities of the computer center.

b) Supervise directly or through subordinate supervisors a small group of technical and nontechnical employees engaged in data processing activities.

c) Develop computer center policies and procedures; confer with and advise subordinate personnel on technical problems, priorities, and methods.

d) Review and approve the application of new systems of the computer.

e) Establish systems development and computer documentation and operation standards.

f) Coordinate major data processing programs or activities involving all elements within the computer center.

g) Direct the preparation and maintenance of necessary records and reports.

h) Perform related work as required.

3. DESIRABLE KNOWLEDGE, ABILITIES, AND SKILLS

a) Extensive knowledge of the operating characteristics, capabilities, limitations, and service requirements of an electronic computer and its auxiliary equipment.

b) Extensive knowledge of the systems and programming techniques of an electronic computer and its peripheral equipment.

c) Thorough knowledge of the current practices and developments in the field of electronic computer operations.

d) Thorough knowledge of the principles of supervision, organization, and administration.

e) Ability to establish and maintain effective working relations with computer center employees and management at all levels.

4. DESIRABLE EXPERIENCE AND TRAINING

a) Extensive and progressively responsible experience in electronic data processing operations,

b) Considerable supervisory and administrative experience,

c) Graduation from a four-year college or university with major course work in business administration, public administration, or related fields, including or supplemented by course work in computer science.

## 3. COMPUTER SYSTEMS ANALYST

### 1. NATURE OF WORK

This is responsible technical work in the development of computer systems. Work is performed with considerable independence within established technical guidelines and is reviewed by the data processing manager through consultation and analysis of results obtained. Work involves --

a) Applying pertinent technical knowledge and experience to the analysis of complex accounting, engineering, or other technical and administrative operations.

b) Preparing systems to adapt such operations for computer processing.

c) Performing research to ascertain the nature, form, and adequacy of source information and the nature and form of results required.

d) Preparing complex flow charts and block diagrams.

e) Coding of machine instructions using appropriate programming languages.

f) Analyzing computer output.

2. EXAMPLES OF WORK

a) Research, analyze, and develop systems for processing fiscal, accounting, engineering, and managerial operations on an electronic computer.

b) Conduct feasibility and cost comparison studies, analyze the need for new systems studies, and establish priorities.

c) Confer with department and division heads in each of the participating jurisdictions to ascertain specific output requirements including types of reports, degree of data summarization, and format for management reports.

d) Confer with personnel of operating units to identify alternatives and to devise plans for obtaining and standardizing input data in the most economical method and design appropriate input forms.

e) Study current systems and procedures and make appropriate revisions or develop revised systems and procedures.

f) Develop systems flowcharts; determine specification for programming; consult with the guides of computer programmers in developing computer programs.

g) Devise procedures and prepare detailed procedural manuals for the operation of the systems.

h) Assist participating organizations in their work with respect to data processing utilization.

i) Perform related work as required.

3. DESIRABLE KNOWLEDGE, ABILITIES, AND SKILLS

a) Thorough knowledge of the applicability of data processing to a variety of situations and processes.

b) Thorough knowledge of the limitations, capabilities, uses, and service requirements of electronic data processing equipment.

c) Considerable knowledge of higher mathematics and the basic principles of administration.

d) Considerable knowledge of block diagramming, flowcharting, and procedural report presentation.

e) Considerable knowledge of electronic data processing coding practices required in programming instructions for an electronic computer and peripheral equipment.

f) Ability to analyze complex problems and logically describe or graphically illustrate workable solutions.

g) Ability to establish and maintain effective working relationships with other employees and officials of other departments.

4. DESIRABLE EXPERIENCE AND TRAINING

a) Considerable computer systems design and programming experience.

b) Graduation from a four-year college or university with major course work in business administration, public administration, or related fields, including or supplemented by course work in computer science.

## C. COMPUTER PROGRAMMER

### 1. NATURE OF WORK

This is technical work in the analysis and preparation of programs of instructions for an electronic computer and peripheral equipment. General instructions are given with new work assignments; however, work is performed with considerable independence in completing assigned projects. Work involves --

a) Responsibility for the application of knowledge of programming in the preparation of computer programs.

b) Operation of a computer console and related peripheral equipment to verify the accuracy and completeness of programs.

c) Assisting in designing new systems or revising existing systems.

### 2. EXAMPLES OF WORK

a) Prepare computer programs and related documentation, specifications, and flowcharts, working from generalized systems and statements of procedures, objectives, and needs.

b) Test, check, analyze, and debug programs; run programs of instruction for review and test purposes; check and analyze specific program details so as to refine all procedures used throughout the program, to reduce computer operating time, and to improve the program; correct program errors and improve techniques by altering order of operations.

c) Assist in designing systems to be programmed.

d) Revise existing programs to reflect changes in system procedures, rules, policies, and regulations.

e) Perform related work as required.

### 3. DESIRABLE KNOWLEDGE, ABILITIES, AND SKILLS

a) Considerable knowledge of current methods and techniques of electronic data processing and computer programming.

b) Considerable knowledge of electronic data processing coding practices necessary for programming instructions for electronic computers.

c) Knowledge of the capabilities and functions of computers and related equipment.

d) Knowledge of block diagramming, flowcharting, and procedural report presentation.

e) Ability to prepare clear, detailed programs of instructions for efficient machine utilization.

f) Ability to establish and maintain effective working relationships with supervisors, associates, and representatives of other departments.

4. DESIRABLE EXPERIENCE AND TRAINING

a) Considerable computer programming experience.

b) Graduation from high school, including or supplemented by advanced course work in programming.

## COMPUTER OPERATOR

1. NATURE OF WORK

This is technical work in the operation of an electronic computer system and peripheral equipment. Assignments are received in the form of programs and computer operating instructions. Although supervision is provided, work is performed with considerable independence and is reviewed by technical superiors through consultation and observation of results. Work involves --

a) Responsibility for operating an electronic computer and all directly connected elements of the system.

b) Readying the equipment for operation, starting it, monitoring operations, and taking prompt corrective action in stop-and-error situations.

2. EXAMPLES OF WORK

a) Receive computer operating instructions and

input data; study programs to become familiar with their content, structure, and input and output requirements.

b) Set up computer and auxiliary equipment, determine that elements are properly set for starting, and start computer.

c) Observe elements for evidence of incorrect operation; monitor control panel for occurrence of error lights.

d) Determine whether machine malfunction or program failure caused an error or stoppage; apply corrective steps or standard operator techniques or return to previously programmed recovery points in cases where stoppage can be corrected; report the more serious errors to a supervisor.

e) Maintain backup systems of various tape programs and keep magnetic media up to date.

f) Operate burster and decollator as required.

g) Prepare necessary records and reports, including machine performance and production reports, and store and supply records.

h) Perform related work as required.

3. DESIRABLE KNOWLEDGE, ABILITIES, AND SKILLS

a) Considerable knowledge of the operation of an electronic computer and its auxiliary equipment.

b) Ability to read, interpret, and apply programs in the operation of an electronic computer and its auxiliary equipment.

c) Ability to diagnose routine program and computer malfunctions.

d) Ability to understand and think in terms of machine logic.

4. DESIRABLE EXPERIENCE AND TRAINING

a) Some experience in the operation of computers and auxiliary equipment.

b) Graduation from high school, supplemented by formal or on-the-job training in the operation of an electronic computer and auxiliary equipment.

## DATA PREPARATION CLERK

### 1. NATURE OF WORK

This is office machine work in the operation of alphanumeric data recorders or keypunch and verifying machines. Work is performed in accordance with specific written and oral instructions and established routines and is evaluated for production and accuracy. Accuracy is self-checked through the verifying process. Work is performed under general supervision after an initial training period. Work involves --

a) Responsibility for the rapid and accurate operation of alphanumeric machines in converting information from source documents to punched cards and tape.

b) Operation of related data processing equipment.

c) Awareness of apparent irregularities in data presented to be prepared and notification to a source or supervisor of such irregularities.

### 2. EXAMPLES OF WORK

a) Convert information from a variety of source documents to punched cards, tape, or disk using an alphanumeric keyboard.

b) Search for and interpret information on the documents.

c) Prepare equipment for processing source documents.

d) Operate verifier in checking the accuracy of input data.

e) Perform routine clerical work, such as maintaining files or compiling routine reports, and operate switchboard.

f) Record and submit production reports.

g) Perform related work as required.

3. DESIRABLE KNOWLEDGE, ABILITIES, AND SKILLS

a) Thorough knowledge of standard data reduction and practices.

b) Knowledge of modern office practices and procedures.

c) Ability to understand and execute oral and written instructions.

d) Ability to achieve a high volume of production and accuracy in keypunching operations.

4. REQUIRED EDUCATION AND EXPERIENCE

a) Graduation from a standard high school, including or supplemented by courses in data reduction and office practices.

b) One year of experience in the operation of data reduction equipment.

# COMPUTER INSTALLATION DEVELOPMENT PLAN

# COMPUTER INSTALLATION DEVELOPMENT PLAN

## GENERAL INSTALLATION CONSIDERATIONS

General installation considerations must include the goals of your EDP organization and the time frame of your preparations. It is important that the time estimates assigned here and throughout the Installation Development Schedule and Project Assignment Chart be realistic.

There is no set pattern for selecting data processing PERSONNEL which applies to every installation. What is important is that definite lines of communication for decisionmaking be established and charted.

## SITE PREPARATION

Site preparation should allow adequate architectural, electrical, and mechanical arrangements for your installation. Expansion plans must not be overlooked. Professional assistance is available from vendors in the form of the consulting services.

## SYSTEMS

Systems relate to the tasks necessary to install your application to take advantage of your computer's capabilities, to fully satisfy your organization's present needs, and to encompass future needs. This topic is related to the planning conversion and beginning conversion.

## OPERATIONS

Operations refer to the computer production of a final report, exception item, or decision data. Besides actual machine operation, it includes keeping complete records of program run time, error conditions, and hardware problems.

A blank set of forms has been included in this plan. They may be used as worksheets during your initial planning. The local vendor will help your staff expand or amend these worksheets as necessary to produce a detailed and complete planning schedule tailored to your installation.

## INSTALLATION DEVELOPMENT SCHEDULE AND PROJECT ASSIGNMENT CHART

This chart is a detailed breakdown of the preparations for installing a computer system. It has been designed to assist you in meeting the various deadlines specified in the installation activity schedule.

# COMPUTER INSTALLATION DEVELOPMENT PLAN

he Installation Development Schedule and Project
ssignment Chart covers five major areas. Each of these
s further broken down to facilitate completing a
etailed development schedule early in the project.
hese categories serve as the basic organization of this
anual and as a guide in measuring the progress of
reparation efforts.

or each Project Assignment Chart sheet there is a
orresponding Installation Development Schedule sheet.
n each line of the Project Assignment Chart (except the
ajor category lines) enter the name of the department
esponsible for that particular aspect of development
nd the name(s) of the person(s) within the department
esponsible for carrying out the assignment. An
stimate of the number of man-days required to fulfill
he assignment must also be made. Using the entries
n these two columns, the entry for the "Latest Date
o Begin" column can be determined.

cross the top of each Installation Development
chedule sheet is a line for entering the months and
mmediately underneath, 52 blocks for entering the
eginning date of each week. Since the preparation for
nd installation of a computer are predicated on a
0-day cycle of events, the scheduled delivery date
or the system would be entered in the 19th column and
he remainder of the dates filled in, working from
ight to left. It will be noted that for each detail
ine there are two rows of blocks representing weeks.
locks in the upper row should be shaded in to indicate
hose weeks during which it is <u>planned</u> to accomplish
he function named in the left-most column of the sheet.
locks in the lower row should be shaded in each week
o indicate those weeks in which the work is <u>actually</u>
ccomplished. A brief glance through the Installation
evelopment Schedule will indicate the status of the
verall project as well as any areas which might
e lagging behind schedule and require immediate
ttention.

ompletion of the Installation Development Schedule
nd Project Assignment Chart should be a joint
enture of the vendor personnel most directly
ssociated with the account, together with key
ustomer personnel. Considerable thought and planning
ust go into the preparation of this form and, once it
s completed, every effort should be made to adhere
o the schedule of events included in it.

# COMPUTER INSTALLATION DEVELOPMENT PLAN

The following subjects are not intended to encompass all of the activities that a user of a computer system may include. The installation plan is intended only as a guideline and to highlight some of the more important activities. Not all time frames will be the same as those depicted for each activity. They are shown only as a guide to the user.

## A. GENERAL

### 1. DEVELOP TENTATIVE SCHEDULE (90).

To be effective, a data processing plan requires a time phase schedule against which to measure progress. Schedules should be realistic from a time estimation viewpoint and flexible enough to cover anticipated events. The secret is not in having a schedule, but in using it. Periodically, the schedules should be reviewed in order to pinpoint progress. Optimism often prevails in schedule preparation. The weekly review is a method for the staff to evaluate satisfactory progress toward installation data. Don't be overoptimistic.

### 2. DEFINE AND CHART EDP ORGANIZATION (90).

The major goals of your EDP organization should be to define the data processing needs of your organization, to attack your EDP problems from an organization viewpoint, and to provide solutions which will realize the full potential of your computer.

### 3. DETERMINE STAFF REQUIREMENTS AND RESPONSIBILITIES (90).

Every installation has unique staff requirements, depending on the size of the system, the types and quantity of data to be processed, and the number and types of applications to be implemented. However, every staff should include a strong installation supervisor, and the majority of the remaining staff should be experienced and/or well-trained prior to arrival of the computer.

### 4. SUBMIT PLAN TO VENDOR (85).

Once the above steps are completed, a copy of the plan should be reviewed by the vendor. This will

keep the vendor advised of your plans and will allow him to be ready to assist you in keeping to your schedule.

5. ORDER SUPPLIES (60).

All paper and forms supplies, storage racks, and magnetic media (disk packs) should be ordered well in advance of the equipment delivery date. Your vendor account manager or local systems analyst can assist you in ordering.

B. PERSONNEL

1. SELECT INSTALLATION SUPERVISOR (90).

a) CRITERIA FOR SELECTION OF INSTALLATION SUPERVISOR:

(1) Experience in coordinating and directing group activities

(2) Understanding of your organization's data processing requirements

(3) Knowledge of your organization's policies and goals

b) RESPONSIBILITIES OF INSTALLATION SUPERVISOR:

(1) Planning phase

Meet with top management to define EDP objectives and present progress reports periodically.

Establish realistic installation development schedule with assistance of vendor personnel.

Interview department heads to learn what operations will be affected by the computer.

Define personnel requirements, prepare job descriptions.

Plan physical site with assistance of vendor personnel and engineering consultants.

Review implementation budget.

(2) Development phase

Supervise and coordinate physical site preparation.

Supervise selection and training of operating personnel.

Order supplies and forms.

Establish conversion procedures.

Establish parallel procedures.

Establish audit control.

Resolve interdepartmental conflicts.

Recommend desirable changes in organization policy and procedures.

(3) Installation and operation phase

Supervise installation of system.

Supervise conversion.

Supervise parallel runs and auditing of controls.

Supervise operation and maintenance of equipment.

(4) Selection of terminal and console operators (90)

Vendor can assist your installation supervisor in establishing the criteria for selection of these people.

(5) Training manuals (85)

Vendor offers comprehensive documentation on all applications. These manuals will guide the installation supervisor through installation and conversion to the actual running of the system.

## C. SITE PREPARATION

### 1. SELECT PHYSICAL SITE (45).

A site must be selected for the processor and for the terminals. Vendor can assist you in the selection and planning of the site. These general considerations should be noted:

a) ACCESSIBILITY TO USERS AND SERVICE PERSONNEL

b) AVAILABILITY OF ADEQUATE POWER

c) ABSENCE OF STRONG VIBRATION AND ELECTRO-MAGNETIC FIELDS

d) ADEQUATE WORK SPACE FOR TERMINAL OPERATORS

### 2. REVIEW ENTIRE HARDWARE LAYOUT (25).

The installation supervisor should review the entire hardware site, keeping in mind the general considerations noted above.

## D. SYSTEMS

### 1. REVIEW SYSTEM (75).

The system should be reviewed to determine if the modules selected and related options will fulfill the needs of the operations. Cost and time advantages, availability of personnel and equipment, and possible long-range effects of the new system must all be taken into consideration at this stage of systems planning.

### 2. DEVELOP CONVERSION PLAN (45).

A plan must be developed for converting your present records to the new systems format.

### 3. MAKE CONVERSION (5).

All current records must be input to the new system. This can be accomplished on-site or at the closest vendor facility.

## E. OPERATIONS

### 1. ESTABLISH OPERATION PROCEDURES (45).

While operations manuals will be provided by the vendor, it will still be necessary for each user to establish internal procedures for input/output, balancing, error corrections, and recovery from system problems.

## INSTALLATION DEVELOPMENT SCHEDULE

| PERIOD | MONTH |
|---|---|
| | WEEK OF |
| General | |
| Develop a tentative EDP plan | |
| Chart EDP organization | |
| Define EDP objectives | |
| Define system to dept. heads | |
| Submit plan to vendor | |
| Plan physical site | |
| Define personnel requirements | |
| Order supplies | |
| | |
| | |
| | |

PROJECT ASSIGNMENT CHART

| ACTIVITY | DEPARTMENT | ASSIGNED TO | ESTI-MATED MAN-DAYS | COMPLE-TION DUE DATE | LATEST DATE TO BEGIN |
|---|---|---|---|---|---|
| General | | | | | |
| Develop a tentative EDP plan | | | | | |
| Chart EDP organization | | | | | |
| Define EDP objectives | | | | | |
| Define system to dept. heads | | | | | |
| Submit plan to vendor | | | | | |
| Plan physical site | | | | | |
| Define personnel requirements | | | | | |
| Order supplies | | | | | |
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